Appendix No. 2

SUMMARY OF PROFESSIONAL ACCOMPLISHMENTS

Andrzej Urbaś

Bielsko-Biala 2023

1. Personal data

a) Name and Surname: **Andrzej Urbaś**

b) Academic Degree: **PhD**

c) Place and Address of Employment:

University of Bielsko-Biala
Faculty of Mechanical Engineering and Computer Science
Department of Mechanical Engineering Fundamentals
Willowa 2, 43-309 Bielsko-Biala

2. Diplomas, degrees conferred in specific areas of science or arts, including the name of the institution which conferred the degree, year of degree conferment, title of the PhD dissertation.

1997-2002	Master's studies
2002	MSc. Eng. Mechanical Engineering, specialization: Technical and IT, University of Bielsko-Biala Faculty of Mechanical Engineering and Computer Science Thesis title: *Experimental modal analysis,* *Part 3 – Modification of dynamic structure properties* Promoter: dr hab. inż. Józef Drewniak, prof. ATH Reviewer: prof. zw. dr hab. inż. Józef Wojnarowski
2002-2006	Doctoral studies
2011	PhD Mechanical Engineering, specialty: Dynamics of machines University of Bielsko-Biala Faculty of Mechanical Engineering and Computer Science Dissertation title: *Dynamic analysis and control of flexible supported machines* Promoter: prof. dr hab. Stanisław Wojciech Reviewers: prof. zw. dr hab. inż. Józef Knapczyk dr hab. inż. Jacek Kłosiński, prof. ATH
2000-2002	Interfaculty Pedagogical Study University of Bielsko-Biala

3. Information on employment in research institutes or faculties/departments or school of arts.

University of Bielsko-Biala

15.10.2003-07.07.2009	Department of Mechanics and Engineering Computer Methods Faculty of Mechanical Engineering and Computer Science	Assistant
08.07.2009-30.09.2011	Department of Computer Science Faculty of Management and Computer Science	Assistant
1.10.2011-31.01.2012	Division of Mechanics Faculty of Mechanical Engineering and Computer Science	Assistant
1.02.2012-31.01.2017	Division of Mechanics Faculty of Mechanical Engineering and Computer Science	Assistant Professor
1.02.2017-still	Department of Mechanical Engineering Fundamentals Faculty of Mechanical Engineering and Computer Science	Assistant Professor

High Mechatronics School in Katowice

1.10.2013-30.09.2014	Department of Mechatronics	Assistant Professor

High Technical School in Katowice

1.10.2014- 30.09.2015	Department of Mechatronics Faculty of Architecture, Civil Engineering and Applied Arts	Assistant Professor
1.10.2015-30.09.2021	Department of Mechatronics Faculty of Architecture, Civil Engineering and Applied Arts	Assistant Professor (contract)

4. Description of the achievements, set out in art. 219 para 1 point 2 of the Act.

The main scientific (habilitation) achievement constituting a significant contribution in the theoretical aspect to the development of the scientific discipline of mechanical engineering, which is the basis for applying for the academic degree of doctor habilitated, is the author's own scientific monograph entitled

Modelling the dynamics of boom cranes with a complex kinematic structure,

published in 2023 by the University of Bielsko-Biała Press.

Reviewers: prof. dr hab. inż. Bogdan Posiadała
Czestochowa University of Technology
prof. dr hab. inż. Jerzy Warmiński
Lublin University of Technology

The research objective of the monograph was to develop a general method of formulating and solving dynamics equations of open-loop kinematic chains with closed-loop sub-chains. The proposed method was used to simulate the dynamics of the boom crane to analyse the influence of the phenomena occurring during the motion on the behavior of the crane and the load.

The monograph is a significant extension of the research initiated in the doctoral dissertation, in which the author limited his research to the formulation of general algorithms enabling the generation of dynamics for grab cranes with the structure of open-loop kinematic chains connected to fixed or mobile base.

The review of the literature shows that the subject of mathematical modeling of cranes and the study of their dynamics with taking into account various phenomena, is still relevant. However, the models described and developed in the literature are most often developed for a selected crane structure and are used to study the impact of a selected phenomenon on the crane dynamics and/or load. In most cases, these applications focus on controlling movements of the crane to shorten the time of the load transfer operation and thus reduce energy consumption to minimize vibration of the crane structure and load swings or its positioning.

The author achieved the research objective in several stages described in the following chapters of the monograph.

The nomenclature presented in Fig. 1 was used to describe the kinematics and dynamics of the boom cranes.

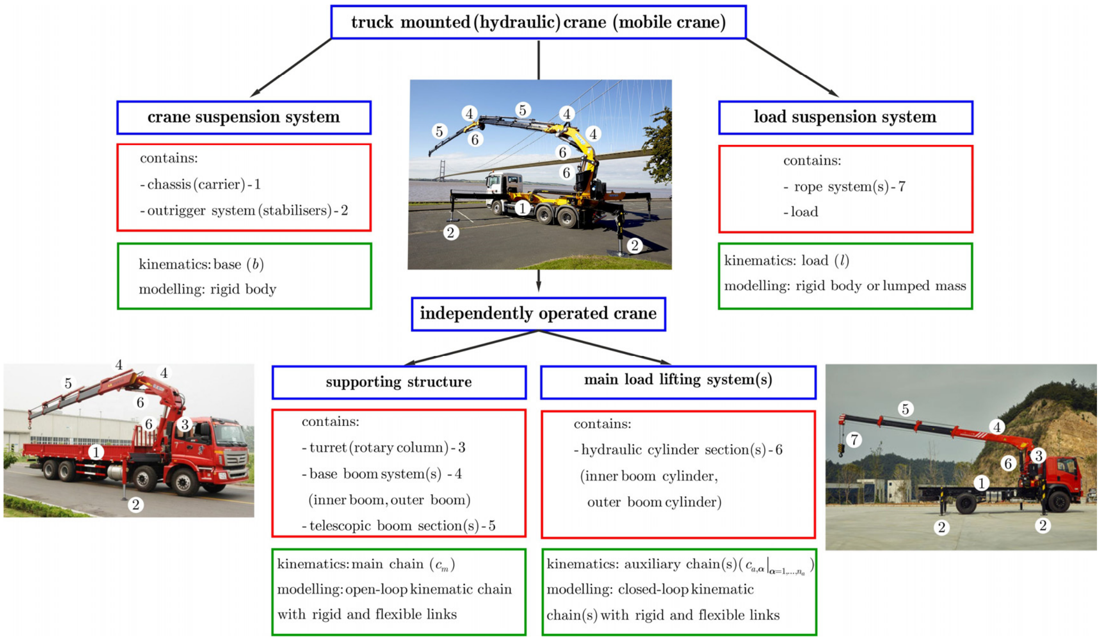

Fig. 1. Nomenclature of boom cranes

The author divides a crane's structure into sub-assemblies and proposes the method for their modelling as follows:

1. crane suspension system;

   The system contains a chassis and an outrigger system.

2. independently operated crane;

This system is divided into:

- supporting structure;

  This structure includes a turret, base boom system(s), and telescopic boom section(s).

- main load lifting system(s);

  The system contains a hydraulic cylinder section(s).

3. load suspension system;

   This system includes a load with a rope or rope systems (lifting sling).

The proposed general model of a boom crane is presented in Fig. 2. It is assumed that the considered structure is built of a main chain (c_m) (in the form of an open-loop kinematic chain with $n_l^{(c_m)}$ links), mounted on the crane's body (b), and n_a auxiliary chains (in the form of closed-loop kinematics chains $c_{a,\alpha}\big|_{\alpha=1,\ldots,n_a}$) with $n_l^{(c_{a,\alpha})}$ number of links.

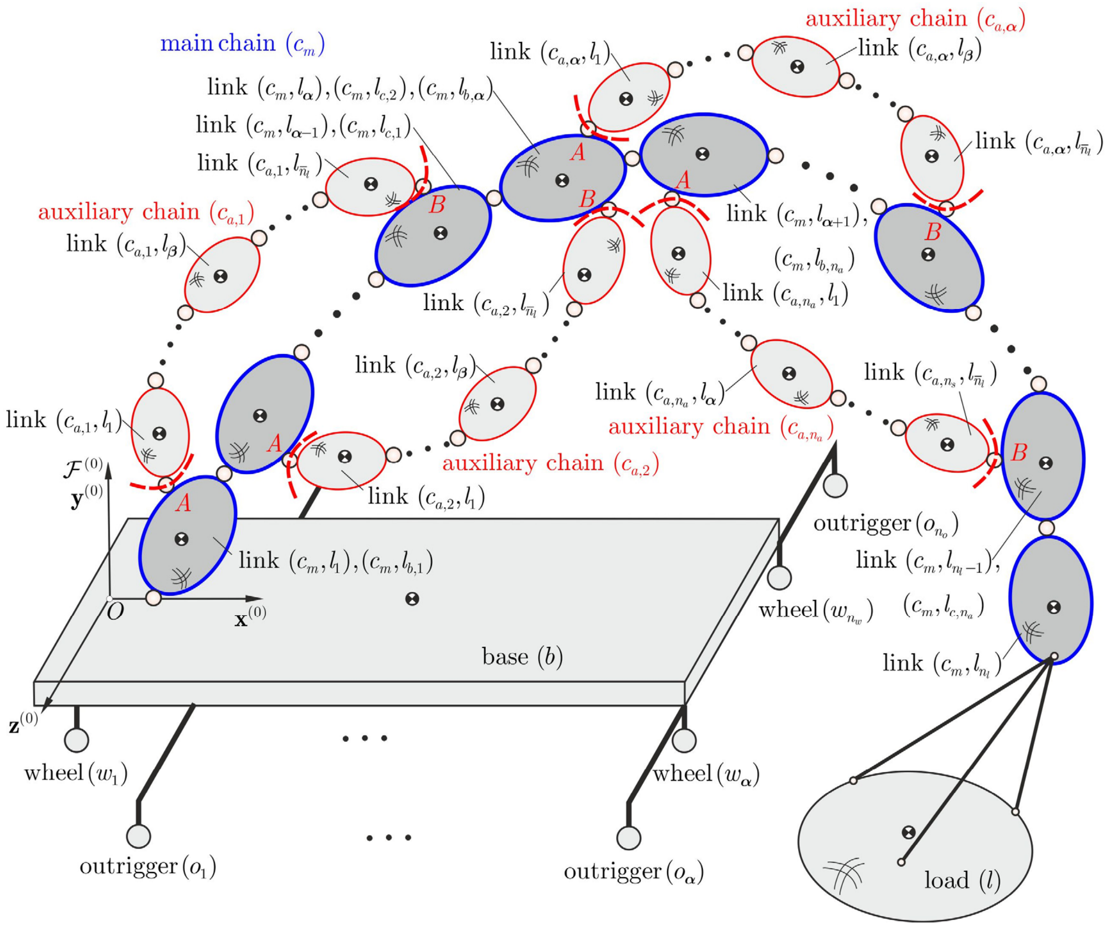

Fig. 2. General model of a boom crane

The auxiliary chains are attached to the links of the main structure, which are called base and closing links and they are denoted as $(c_m, l_{b,\alpha})\big|_{\alpha=1,\ldots,n_a}$ and $(c_m, l_{c,\alpha})\big|_{\alpha=1,\ldots,n_a}$, respectively. The system is supported on the ground by means of n_o outriggers ($o_\alpha\big|_{\alpha=1,\ldots,n_o}$) and n_w wheels ($w_\alpha\big|_{\alpha=1,\ldots,n_w}$).

The motion of the boom crane is defined by the following generalised coordinates vector

$$\mathbf{q}=\left[\mathbf{q}^{(c)^T} \;\middle|\; \mathbf{q}^{(l)^T}\right]=\left[\hat{\mathbf{q}}^{(b)^T} \quad \overline{\mathbf{q}}^{(c_m)^T} \quad \overline{\mathbf{q}}^{(c_{a,1})^T} \quad \cdots \quad \overline{\mathbf{q}}^{(c_{a,\alpha})^T} \quad \cdots \quad \overline{\mathbf{q}}^{(c_{a,n_a})^T} \;\middle|\; \mathbf{q}^{(l)^T}\right]^T,$$

where: $\mathbf{q}^{(c)}$, $\mathbf{q}^{(l)}$ is a vector of generalised coordinates describing the motion of the crane and the load,

$\hat{\mathbf{q}}^{(b)}$ is a vector of generalised coordinates describing the motion of base (b) with respect to the reference system,

$\overline{\mathbf{q}}^{(c_m)}$ is a vector of generalised coordinates describing the motion of the main chain (c_m) with respect to base (b),

$\overline{\mathbf{q}}^{(c_{a,\alpha})}\Big|_{\alpha=1,\ldots,n_a}$ is a vector of generalised coordinates describing the motion of the auxiliary chain $(c_{a,\alpha})$ with respect to base link $(c_m, l_{b,\alpha})$.

The Lagrange equations of the second kind are used to formulate the dynamics equations of a rigid or flexible link. The derivation process of the dynamics equations and their matrix form is presented for a rigid link. The rigid finite element method (RFEM - Fig. 3) is used to discretize the flexible link (in the classical - Fig. 4 and modified - Fig. 5 approach). The generalised forces due to the elastic deformation of the link are calculated employing the elastic potential energy and the Rayleigh dissipation function. The matrix form of these equations is formulated, taking into account the relationships resulting from the deformation of a link (the elastic potential energy and the Rayleigh dissipation function were used).

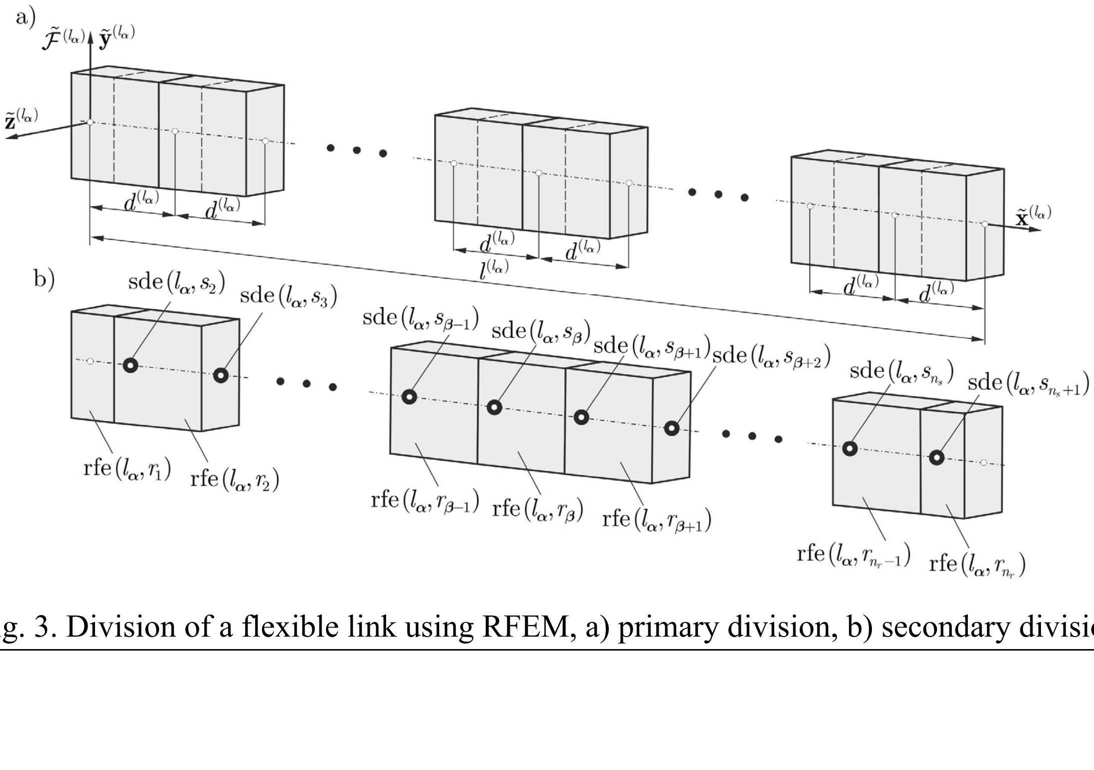

Fig. 3. Division of a flexible link using RFEM, a) primary division, b) secondary division

Both approaches of RFEM are given by the author in an original way that allows for their easy interpretation and easy computer implementation.

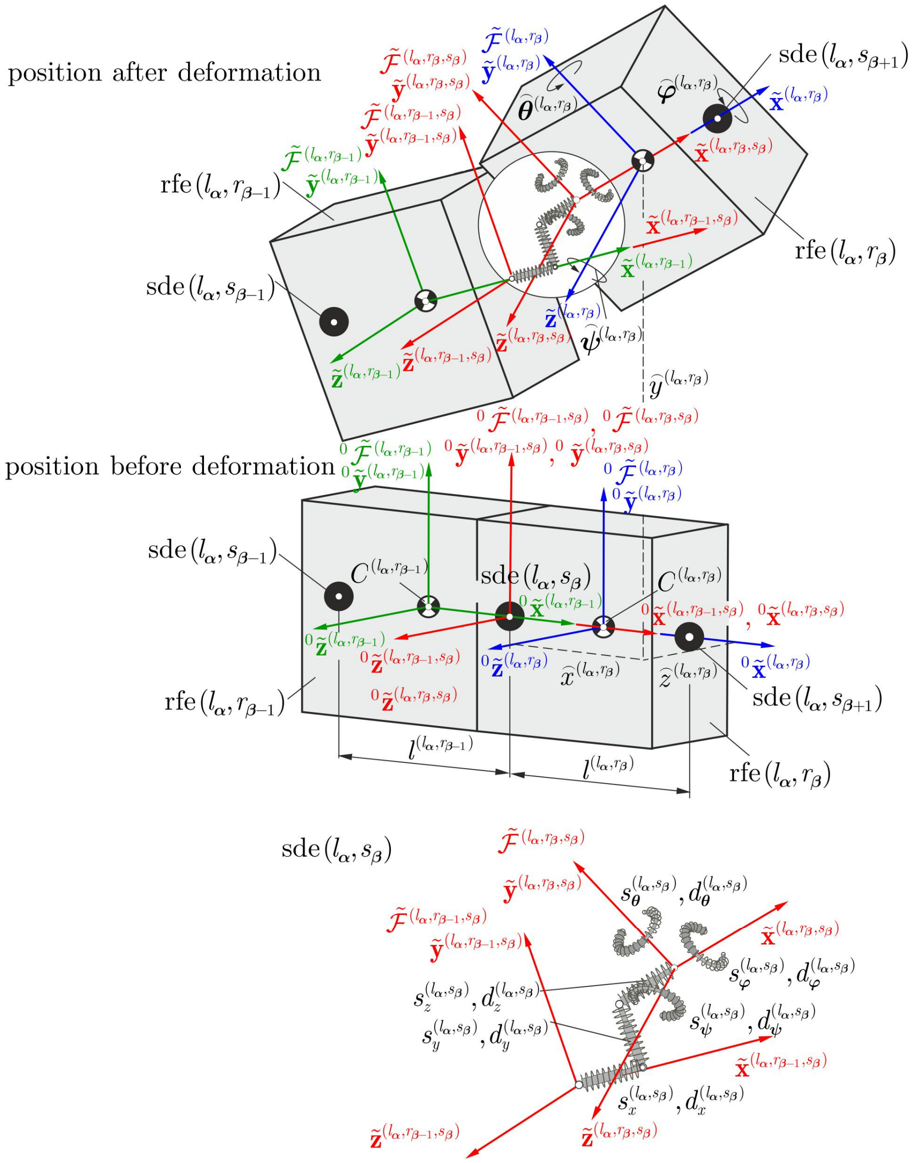

Fig. 4. Classical approach of rigid finite elements method

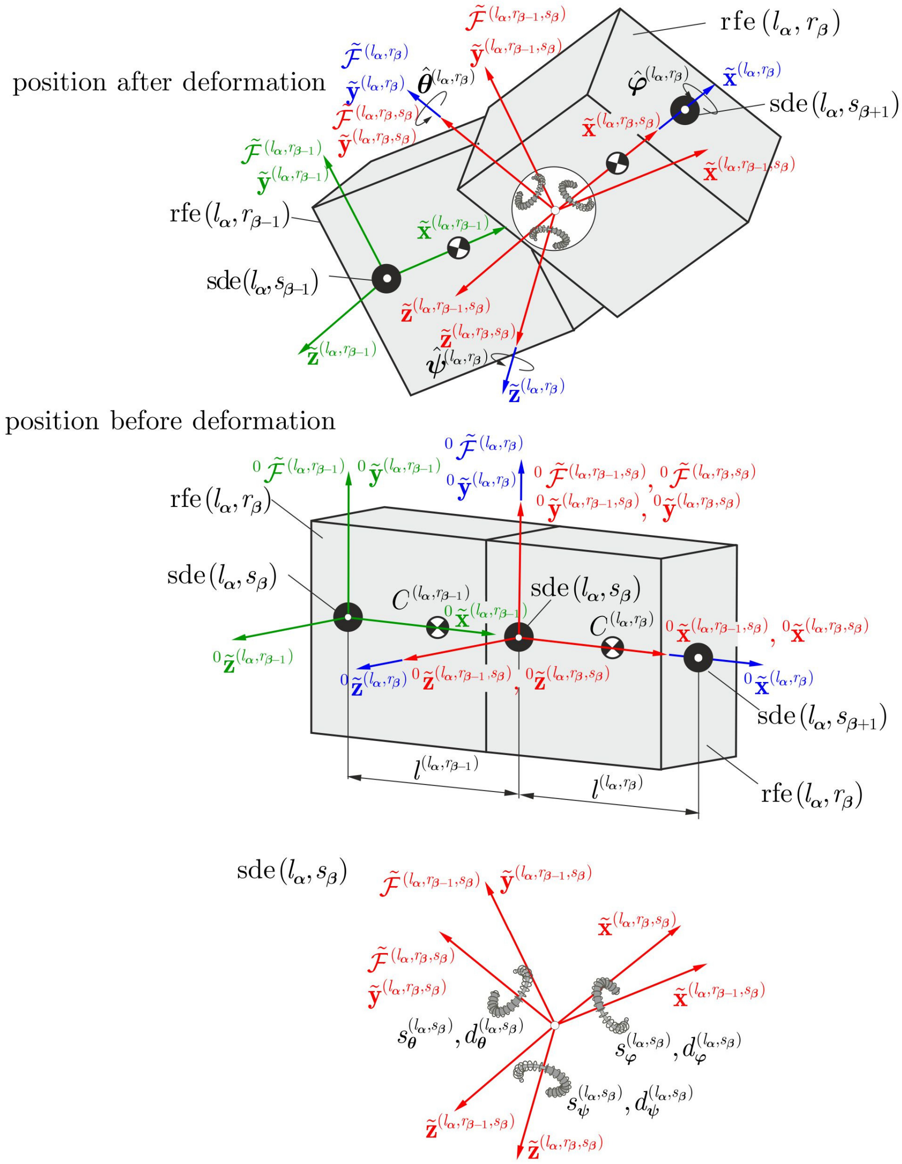

Fig. 5. Modified approach of rigid finite elements method

The proposed formalism is applied by the author to develop a mathematical model of the crane. The model of the flexible supported crane base, i.e. the platform and the system of wheels and outriggers, is shown in Fig. 6. A unidirectional spring-damping elements (3D) are introduced in the places of wheel-ground and outrigger-ground connections. Formulas for the elastic potential energy and the Rayleigh dissipation function are derived and presented in the monography.

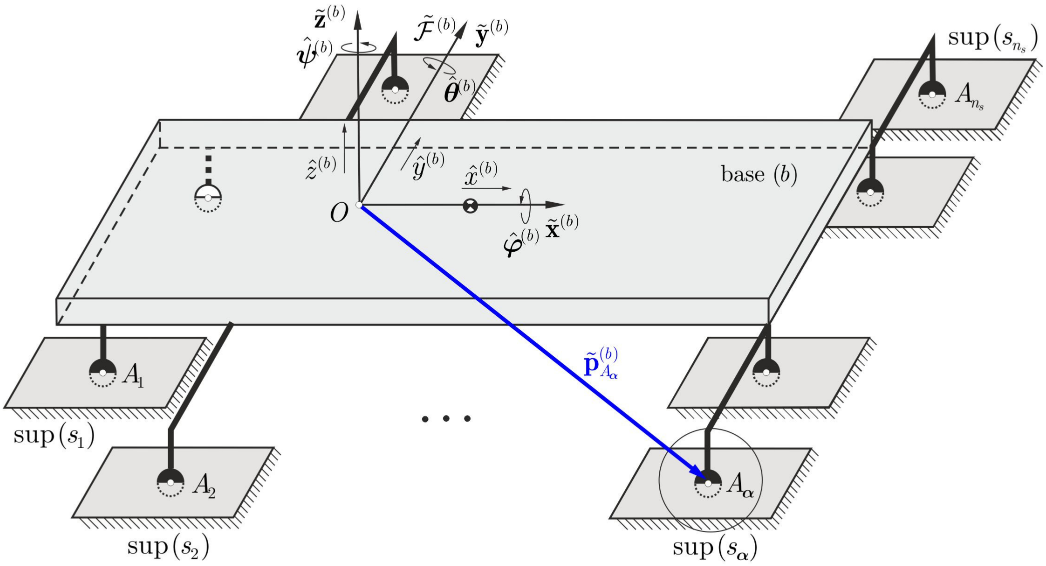

Fig. 6. Model of a flexible supported base

The supporting structure of the crane is modelled in the form of an open-loop main kinematic chain with any number of links (Fig. 7). Links can be modelled as rigid or flexible and can be connected by any kinematic pair. The author presented an algorithm for generating dynamics equations of the crane's supporting structure. These equations are derived in the matrix form which facilitates the aggregation of the mass matrix and the generalised forces vector for the following links of the main chain.

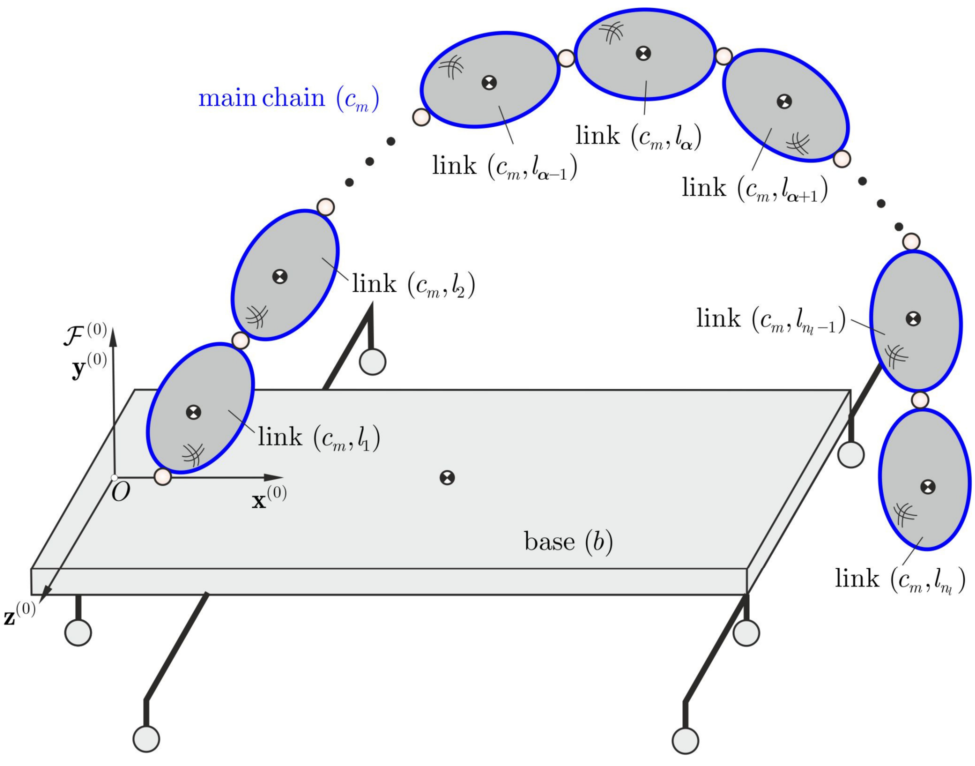

Fig. 7. Model of the supporting structure of the crane

Next, the algorithm for generating dynamics equations of closed-loop kinematic chains attached to the main chain (called auxiliary chains) is presented (Fig. 8).

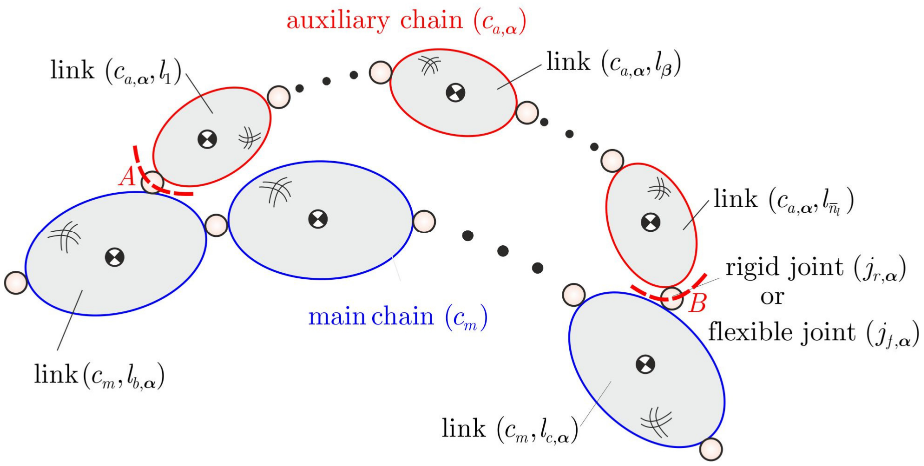

Fig. 8. Attachment of an auxiliary chain to the main chain

It is assumed that closed-loop kinematic auxiliary chains can be connected to the main chain kinematic chain using two approaches. The first, called a rigid attachment, assumes that the last link of the auxiliary chain is rigidly attached to the selected link of the main chain (Fig. 9). Then, the joint is imaginary cut to formulate the dynamics equations. This step leads to a kinematic structure in the form of a tree. At the cut-joint, unknown reaction forces and torques are introduced which are taken into account on the left side of the dynamics equations. Additionally, the dynamics equations are supplemented by six constraint equations, which are formulated in the acceleration form. Contrary to the approaches used in the literature, the reaction forces and torques at the cut-joint and the constraint equations are determined with to the closing link of the main chain.

By changing the number of constraints in the cut-joint, you can take into account the relative motion of the connected links, and thus model kinematic pairs of any class. However, this approach requires additional stabilization of the constraint equations.

The second approach, called also a flexible attachment, consists in connecting the auxiliary chain link with the main chain link by means of a spring-damping element, i.e. a system of six springs (three translational and three rotational) and six dampers (three translational and three rotational) - Fig. 10. Deformation of the spring-damping element is determined in the system of the closing link of the main chain. Such approach requires sssuming high values of stiffness and damping coefficients to limit (block) the relative motion of the joined links.

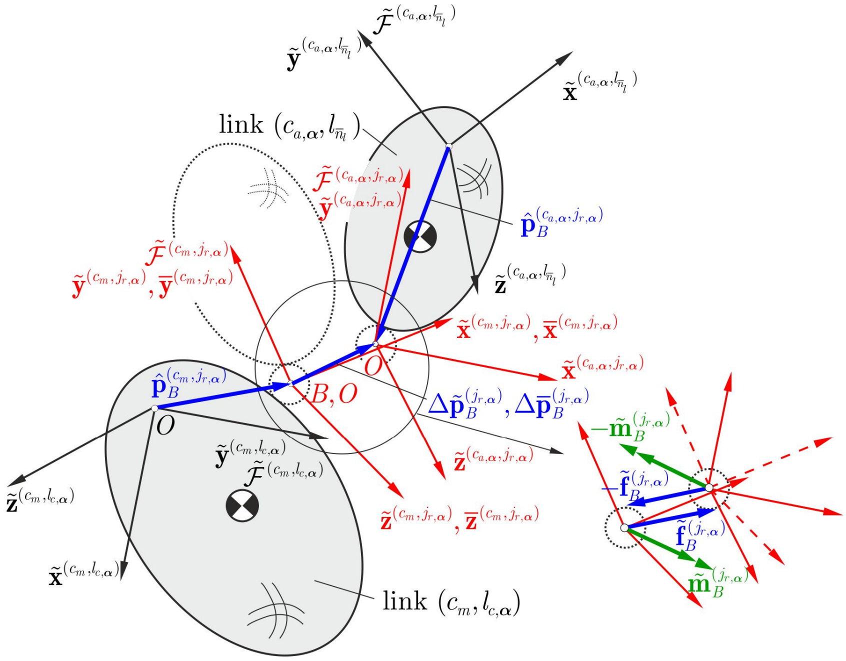

Fig. 9. Model of the rigid attachment of an auxiliary chain to the main chain

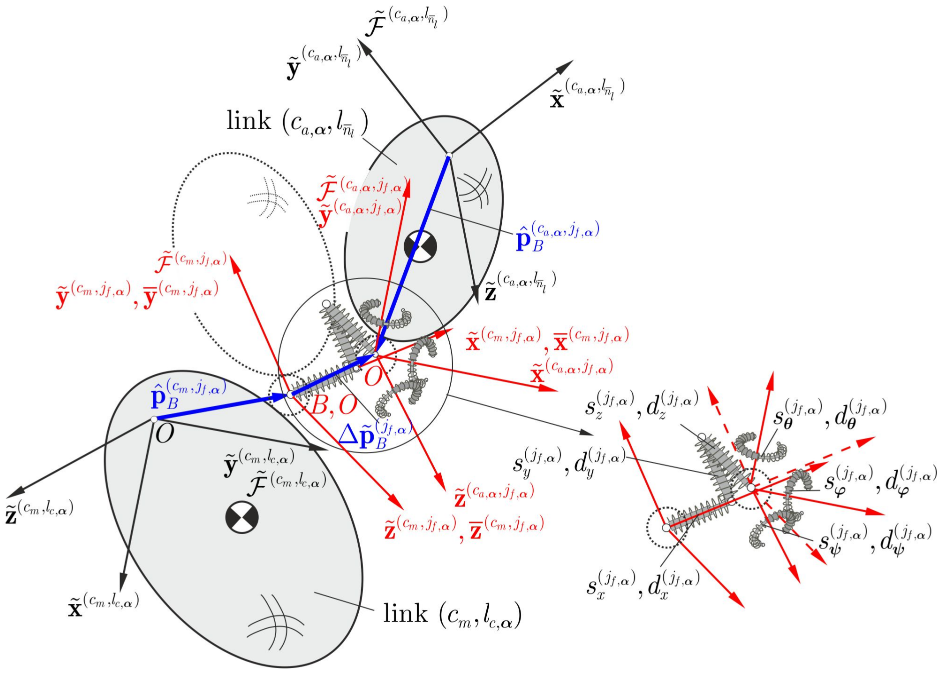

Fig. 10. Model of the flexible attachment of an auxiliary chain to the main chain

This approach eliminates the need to take into account the forces and torques in the connection and to formulate constraint equations, but it requires determination of the elastic potential energy and the Rayleigh dissipation function of the spring-damping element and using the smaller integration step size in numerical simulations.

The author presents two approaches to modelling the load to investigate the influence of the load geometry and a rope sling system on its dynamics. In the first one, it is assumed that the load is a lumped mass (it has 3 degrees-of-freedom - Fig. 11), and in the second one, it is a rigid body (it has 6 degrees-of-freedom - Fig. 12). As a consequence, the dynamics equations have a different structure depending on the assumed load model.

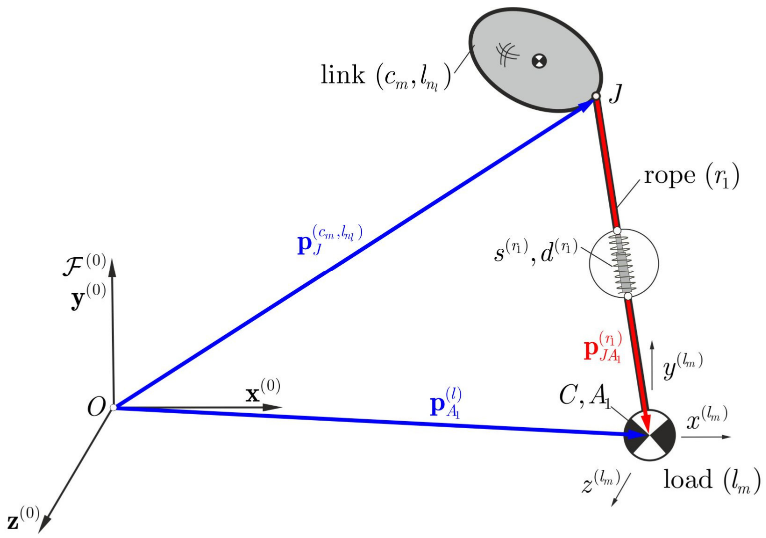

Fig. 11. Load modelled as a lumped mass

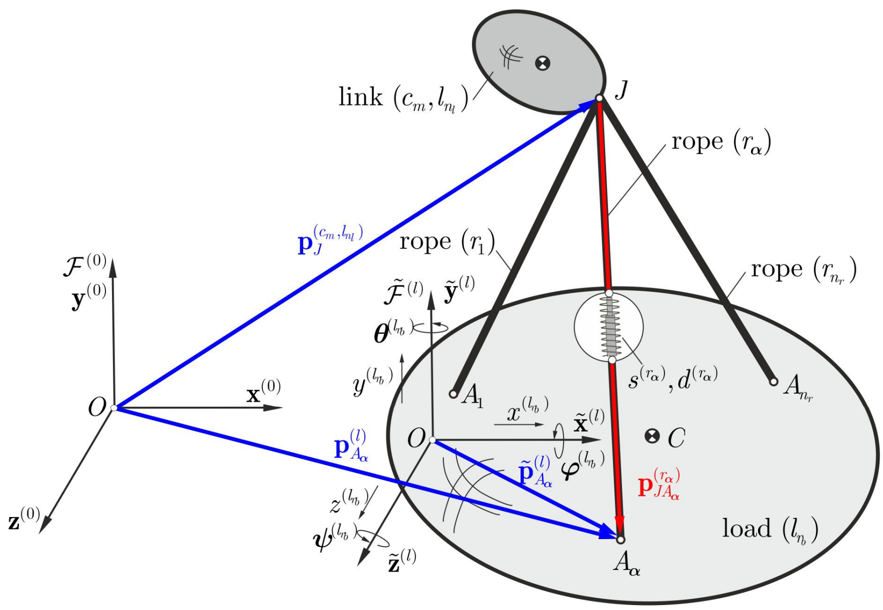

Fig. 12. Load modelled as a rigid body

In both cases, the motion of the load is analyzed in frame of reference $\mathcal{F}^{(0)}$. The model allows to suspend the load on one rope or on a sling ropes system. The ropes are modelled using spring-damping elements, but only their stretching is possible. The relationships for determining the elastic potential energy and the Rayleigh dissipation function which complement the dynamics equations are presented in the monograph.

Two approaches of drive modelling are analyzed in the monograph - rigid and flexible. In the first one, a generalized force is applied (a force for a prismatic joint - Fig. 13 or a torque for a revolute joint - Fig. 14) to enforce the movement of the driving link.

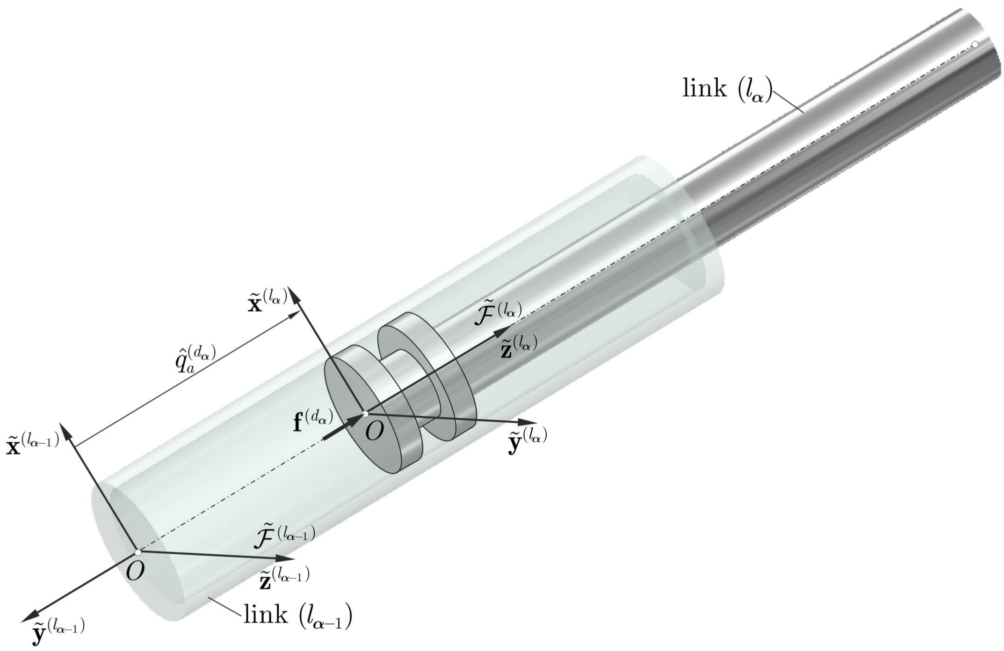

Fig. 13. Model of a rigid drive of a prismatic joint

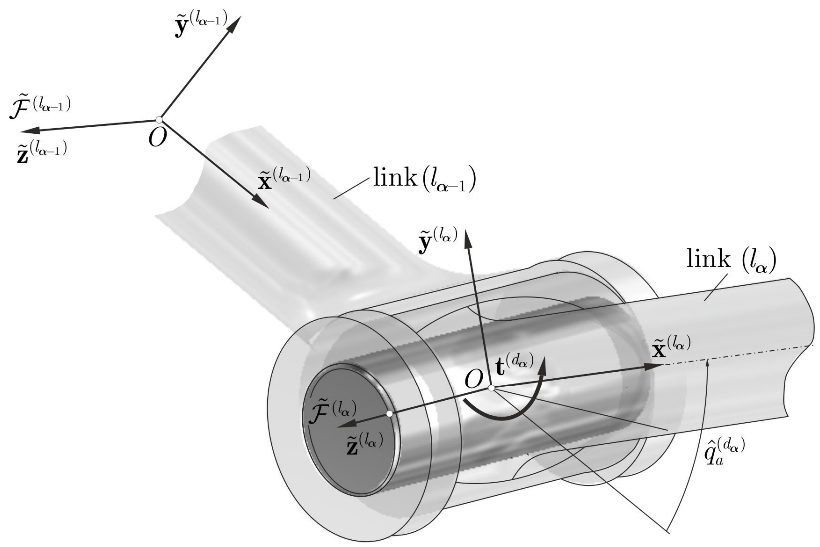

Fig. 14. Model of a rigid drive of a revolute joint

With the assumed motion of the driving link resulting from the constraint equations, the force or torque is unknown and it is taken into account on the left side of the dynamics equations in the form of a generalized force.
The second approach of the drive modelling allows to include its flexibility. The flexibility of the drive (e.g. due to the flexibility of parts of the drive, leaks or air in the hydraulic system) is modelled using a spring-damping element (translational - Fig. 15 or rotational - Fig. 16).

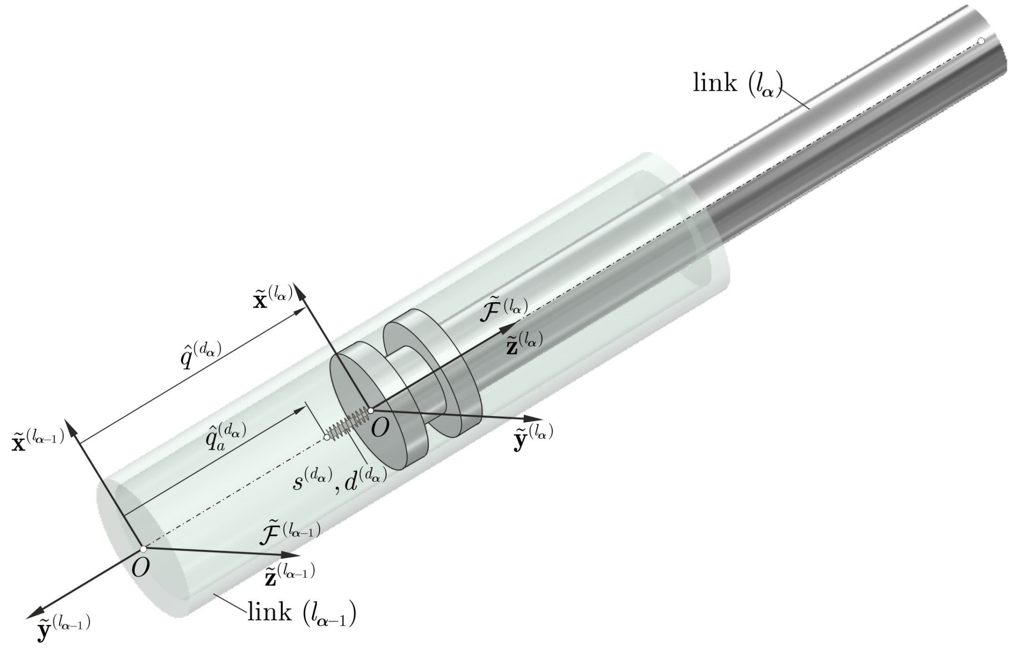

Fig. 15. Model of a flexible drive of a prismatic joint

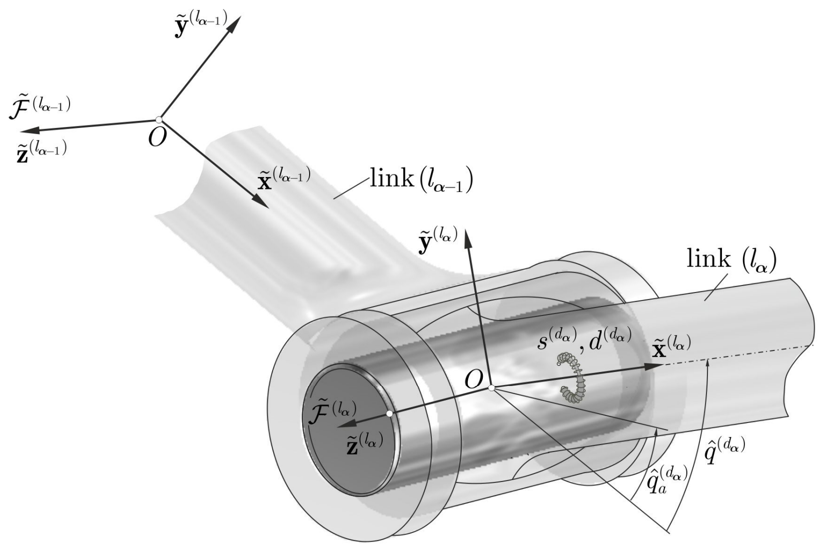

Fig. 16. Model of a flexible drive of a revolute joint

In the case of flexible drives, it is necessary to formulate the appropriate relationships for the elastic potential energy and the Rayleigh dissipation function of the spring-damping element, which are then introduced into the dynamics equations. It is worth to note that flexibility of the drive requires the use of a smaller integration step size in numerical calculations..

The author uses Dahl and LuGre "bristle" friction models (most often described in the literature of recent years) to model dry friction in joints. Both models are described by a first-order ordinary differential equation, referring to the deformation velocity of a single "bristle", which occurs at the point of contact of two friction surfaces. The bristle friction models make possible to take into account other phenomena occurring when rough surfaces slide over each other. The author proposes appropriate models of kinematic pairs with friction. Since in the analyzed crane model there are only kinematic pairs of the fifth class, depending on the type of connection, the models of a revolute joint with friction (Fig. 17 and 18) and a prismatic joint with friction (Fig. 19 and 20) should be used.

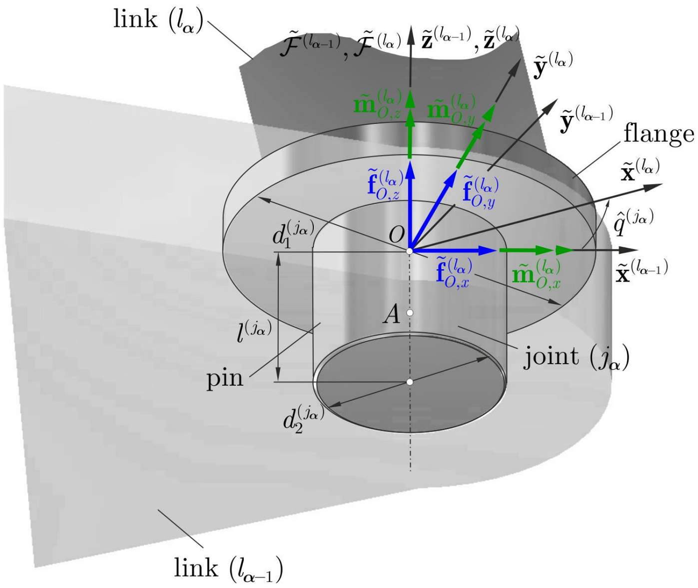

Fig. 17. Model of a revolute joint - connection of the main structure to the flexible supported base

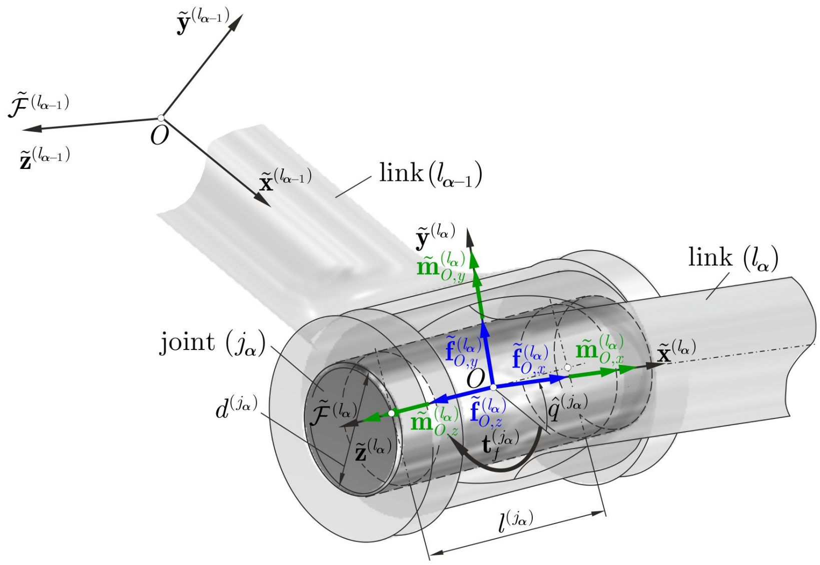

Fig. 18. Model of a revolute joint connecting of links of the crane

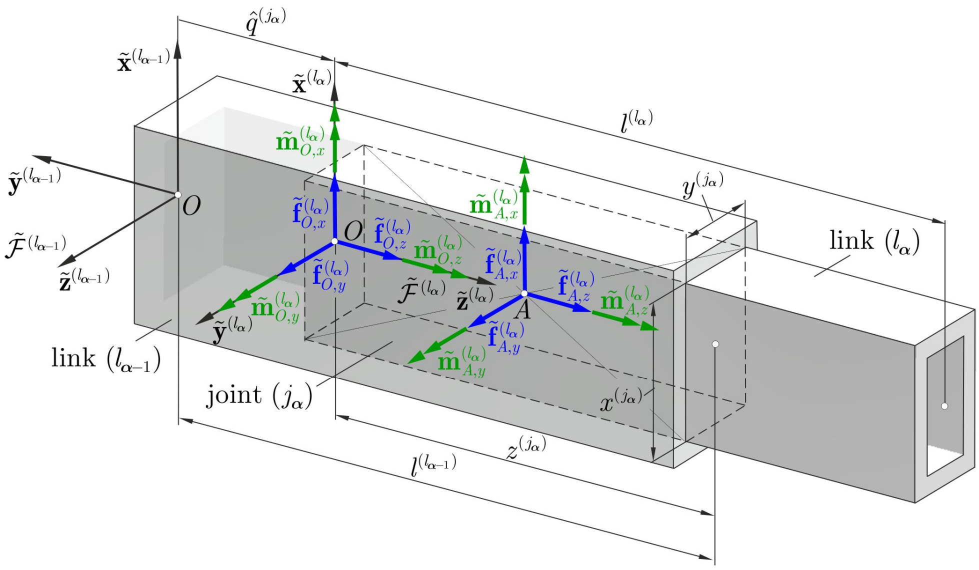

Fig. 19. Model of a prismatic joint in a telescoping section

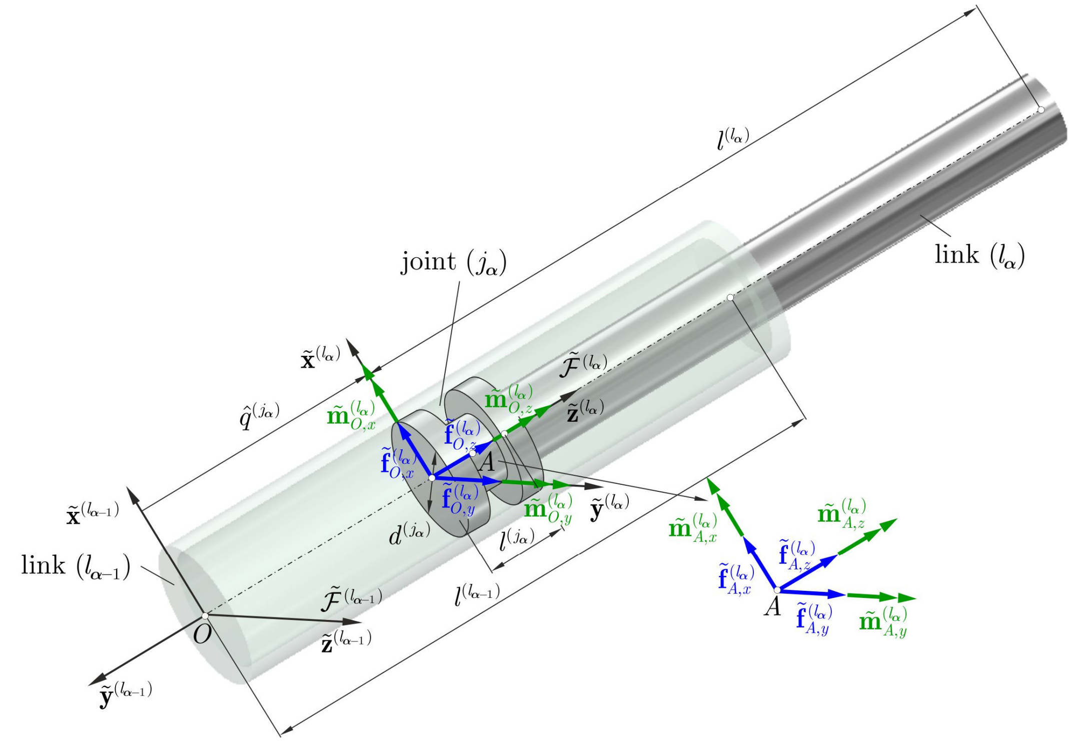

Fig. 20. Model of a prismatic joint in hydraulic cylinder

Due to the complex kinematic structure (an open-loop kinematic chain with any number of closed-loop attached chains, the links of which can be connected by any kinematic pair and these links can be acted on by external forces and torques), the author modified the outward and inward loops of the Newton-Euler recursive algorithm. The developed algorithm makes it possible to include in the model flexible links, discretized by the rigid finite element method. The joint forces and torques obtained for the iterative Newton-Euler algorithm are applied to determine the normal force, and then, depending on the kinematic pair, the friction force or torque in the joint.

All algorithms for generating dynamics equations of crane systems are written in such a way that they can be aggregated into one system of dynamics equations for the crane and load, with the help of which it is possible to analyze the influence of crane structure flexibility, friction in joints, load geometry, and drives flexibility. The author presents four variants of systems of dynamics equations together with constraint equations.

The developed method for generating dynamics equations and the algorithm for solving them are used by the author to simulate the model of the boom crane shown in Fig. 21.

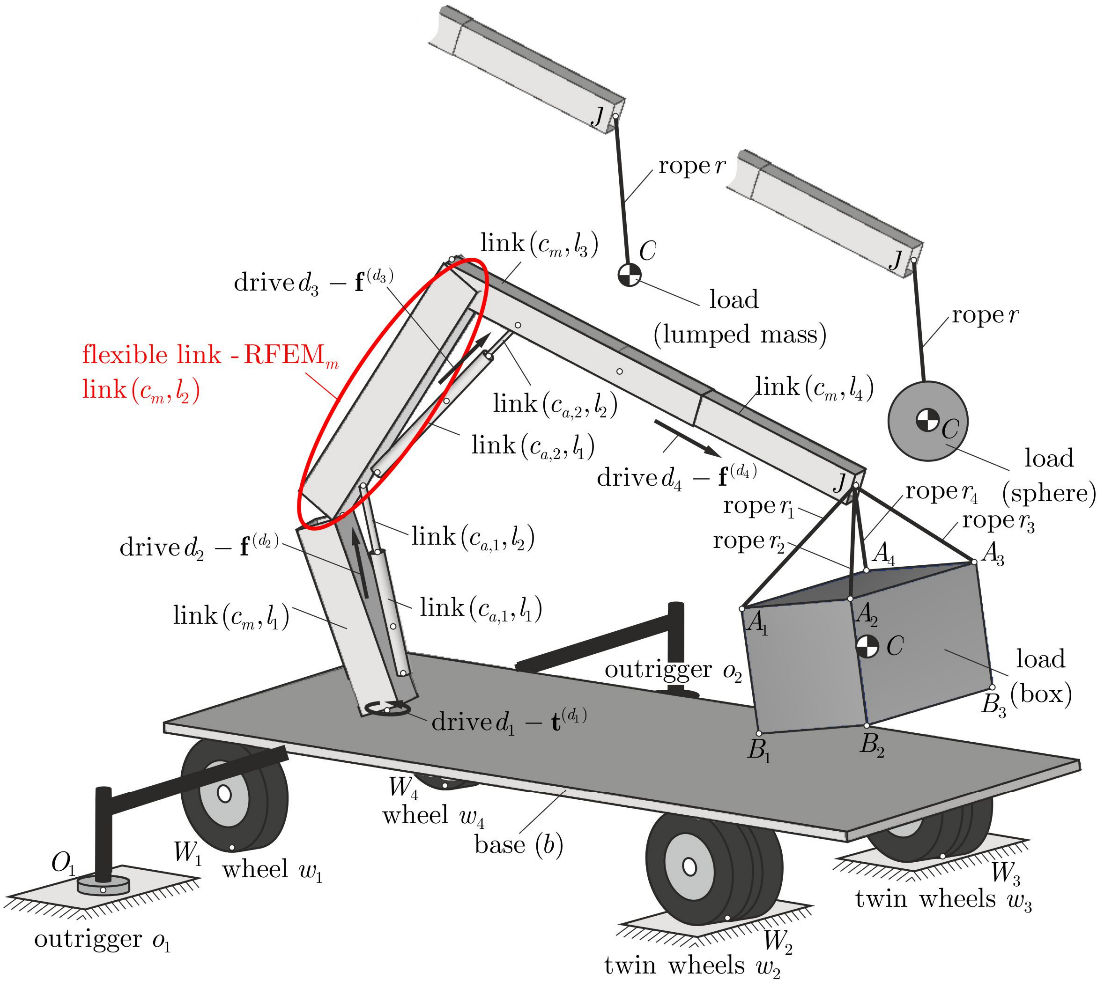

Fig. 21. Scheme of the model of the boom crane

The author's program used in the simulations is validated by comparing the obtained results with those obtained using commercial software. The correctness and effectiveness of the developed algorithms and computer program are confirmed. Original indicators for assessing the load positioning and for assessing the dynamics of the crane and load are also proposed.

To sum up, the most important achievements of the monograph, which in the author's opinion can be treated as a contribution to the scientific discipline of mechanical engineering, include

1. formulation of a general mathematical model of complex kinematic structures containing a main chain and any number of auxiliary chains.
   Both the main chain and the auxiliary chains can contain any number of links that can be considered as rigid or flexible,
2. presentation of the generalised procedure of attaching auxiliary chains to the main chain,
3. development of a modified recursive Newton-Euler algorithm for complex kinematic structures in which the links are rigid or flexible and they can be connected by any kinematic pair,
4. development of models of kinematic pairs of the fifth class (intended for crane structures), which take into account the phenomenon of dry friction,
5. validation of mathematical models and algorithms implemented using the author's program and commercial packages,
6. proof that the flexibility of drives, links and in particular, the load modelling method are essential in the dynamics analysis.

The presented method can be applied to any mechanical systems with a kinematic structure in the form of an open-loop main kinematic chain with attached closed-loop auxiliary kinematic chains.

4.1. Publication achievements

The publications are compiled on the basis of the bibliography of the employees of the University of Bielsko-Biała. (http://bibliografia.ath.bielsko.pl/)

- **monograph, script:**
  - **before the doctorate;**

M1. **Urbaś A.**: Analiza dynamiczna i sterowanie maszynami roboczymi posadowionymi podatnie, praca doktorska, 150 str., Akademia Techniczno-Humanistyczna, Wydział Budowy Maszyn i Informatyki, 2010,

- **after the doctorate;**

M1. **Urbaś A.**, Modelling the dynamics of boom cranes with a complex kinematic structure, Wydawnictwo Akademii Techniczno-Humanistycznej, Bielsko-Biała, 2023, 190 str., MEiN$_{2023}$:120pkt.,

S1. **Urbaś A.**, Juraszek J.: Mechanika - statika, VŠB - Technická univerzita, 2013, 165 str., MNiSW$_{2013}$:25pkt., (AU:50%).

➢ **chapter in a monograph:**

- **before the doctorate;**

R1. **Urbaś A.**, Wojciech S.: Dynamic analysis of the gantry crane used for transporting BOP. Modeling, Simulation and Control of Nonlinear Engineering Dynamical Systems - State-of-the Art, Perspectives and Applications, Springer Science+Busines Media B.V., Heidelberg, 2009, MNiSW$_{2009}$:7pkt., (AU:50%),

R2. **Urbaś A.**, Augustynek K., Sidzina M., Janusz J.: Badania doświadczalne uproszczonego modelu żurawia chwytakowego, Teoria maszyn i mechanizmów/red. Józef Wojnarowski, Iwona Adamiec-Wójcik, Wydawnictwo Akademii Techniczno-Humanistycznej, 255-262, 2008, (AU:25%),

R3. Augustynek K., **Urbaś A.**, Harlecki A.: Wpływ podatności członów i tarcia suchego na dynamikę ruchu płaskich mechanizmów dźwigniowych. Teoria maszyn i mechanizmów/red. Józef Wojnarowski, Mirosław Galicki, Oficyna Wydawnicza Uniwersytetu Zielonogórskiego, 2006, (AU:30%),

R4. Augustynek K., Drewniak J., Mendrok K., **Urbaś A.**: Ćwiczenia dydaktyczne z analizy modalnej, Zagadnienia analizy modalnej konstrukcji mechanicznych: praca zbiorowa / red. Tadeusz Uhl, Kraków, 2003, (AU:25%),

- **after the doctorate;**

R1. Augustynek K.✉, **Urbaś A.**: The dynamics analysis of a spatial linkage with flexible links and imperfect revolute joints, Perspectives in dynamical systems I : mechatronics and life sciences, Springer Proceedings in Mathematics and Statistics, 2021, 145-158, MEiN$_{2021}$:20pkt., (AU:50%),

R2. **Urbaś A.**✉, Augustynek K.: Evaluation of the cranes actuators strength based on the results obtained from dynamics model, Perspectives in dynamical systems II: mathematical and numerical approaches, Springer Proceedings in Mathematics and Statistics, 2021, 99-112, MEiN$_{2021}$:20pkt., (AU:50%),

R3. Augustynek K.✉, **Urbaś A.**: Analysis of the influence of the links flexibility and clearance effects on the dynamics of the RUSP linkage, Multibody Dynamics 2019: proceedings of the 9th ECCOMAS thematic conference on Multibody Dynamics, Springer International Publishing, 2020, Vol. 53, 104-111, MEiN$_{2020}$:20pkt., (AU:50%),

R4. **Urbaś A.**✉, Augustynek K.: Mathematical model of a crane with taking into account friction phenomena in actuators, Multibody Dynamics 2019: Proc. of the 9th ECCOMAS thematic conference on Multibody Dynamics, Springer International Publishing, 2020, Vol. 53, 299-306, MEiN$_{2020}$:20pkt., (AU:50%),

R5. Jarzębowska E.✉, Augustynek K., **Urbaś A.**: Dynamics and vibration analysis of a spatial linkage model with flexible links and joint friction subjected to position and volecity motion constraints. Applicable solutions in non-linear dynamical systems, 2019, 215-226, MEiN$_{2019}$:20pkt., (AU:30%),

R6. Jarzębowska E.✉, Augustynek K., **Urbaś A.**: Vibration of a planar linkage structure with flexible support subjected to kinematic task based constraints. Advances in mechanism and machine science: Proc. of the 15th IFToMM World Congress on Mechanism and Machine Science, Springer International Publishing, 2019, 3137-3146, MNiSW$_{2019}$:20pkt., (AU:30%),

R7. Jarzębowska E.✉, Augustynek K., **Urbaś A.**: Development of a computational based reference dynamics model of a flexible link manipulator. Dynamical systems in applications, Springer International Publishing, 2018, Vol. 249, 169-180, MNiSW$_{2019}$:20pkt., (AU:30%),

R8. Jarzębowska E.✉, Augustynek K., **Urbaś A.**: Computational reference dynamical model of a multibody system with first order constraints, ASME 2017 International Design Engineering Technical Conferences and Computers and Information in Engineering Conference, 2017, Vol. 6, 1-8, MNiSW$_{2017}$:20pkt., (AU:30%),

R9. **Urbaś A.**, Jabłoński A.✉, Kłosiński J., Augustynek K.: Dynamics and control of a truck-mounted crane with flexible jib, Engineering, dynamics and life sciences, 2017, 553-566, MNiSW$_{2017}$:20pkt., (AU:25%),

R10. **Urbaś A.**, Jabłoński A.✉, Kłosiński J.: Dynamics of a truck-mounted crane when taking into account the flexibility of the hoist system and friction, Materiały konferencji Problemy rozwoju maszyn roboczych: XXX Konferencja PRMR, 2017, 1-16, $MNiSW_{2017}$:5pkt., (AU:30%),

R11. Augustynek K.✉, **Urbaś A.**: Two approaches of the rigid finite element method to modelling the flexibility of spatial linkage links, Proc. of the 8th ECCOMAS Thematic Conference on Multibody Dynamics 2017, 287-296, $MNiSW_{2017}$:5pkt., (AU:50%),

R12. **Urbaś A.**✉, Harlecki A.: Application of the Rigid Finite Element Method and the LuGre friction model in the dynamics analysis of grab cranes, Proc. of the 4th Joint International Conference on Multibody System Dynamics, 2016, 1-18, (AU:50%),

R13. **Urbaś A.**✉: Application of the Rigid Finite Element Method in the dynamics of grab cranes, Dynamical systems: mathematical and numerical approaches, 2015, 555-566,

R14. Harlecki A., **Urbaś A.**✉: Dynamics simulations of spatial linkages using the LuGre friction model, Dynamical systems: mathematical and numerical approaches, 2015, 255-266, (AU:50%),

R15. Harlecki A., **Urbaś A.**✉: Forward dynamics of selected spatial one-dof linkage mechanisms with the Dahl friction model in revolute joints, Multibody Dynamics 2015: ECCOMAS Thematic Conference on Multibody Dynamics 2015, 542-553, (AU:50%),

R16. Harlecki A., **Urbaś A.**✉: Modelling friction phenomena in dynamic analysis of spatial linkages, Book of proceedings of 56th International Conference of Machine Design Departments, 357-362, (AU:50%),

R17. **Urbaś A.**✉, Harlecki A., A dynamic analysis of the selected class of spatial one-dof linkage mechanisms, Proc. of the 12th Conference Dynamical Systems - Theory and Applications, 2013, 471-480, (AU:50%),

R18. **Urbaś A.**✉: Dynamics of grab cranes with flexibly supported base, Dynamical systems: nonlinear dynamics and control, 2011, 337-342.

- **papers from the JCR list:**
  - **before the doctorate;**

F1. **Urbaś A.**✉, Szczotka M. , Maczyński A.: The analysis of movement of the BOP crane under sea weaving conditions, Journal of Theoretical and Applied Mechanics, No. 3 (2010), Vol. 48, IF_{2010}:0.264, $MNiSW_{2010}$:9pkt., (AU:30%),

- **after the doctorate;**

F1. Jarzębowska E., Augustynek K., **Urbaś A.** ✉: Dynamics modeling method dedicated to system models with open- and closed-loop structures subjected to kinematic and task based constraints, Nonlinear Dynamics, 2023, IF_{2023}: 5.741, $MEiN_{2023}$:140pkt., (AU:30%), 10.1007/s11071-023-08471-1,

F2. Augustynek K., **Urbaś A.**✉: Numerical investigation on the constraint violation suppression methods efficiency and accuracy for dynamics of mechanisms with flexible links and friction in joints, Mechanism and Machine Theory, 2023, IF_{2023}:4.93, $MEiN_{2023}$:200pkt., (AU:50%),

F3. Jarzębowska E.✉, Augustynek K., **Urbaś A.**: Motion tracking of a rigid-flexible link robotic system in an underactuated control mode, Bulletin of the Polish Academy of Sciences, 2023, IF_{2023}:1.515, $MEiN_{2023}$:100pkt., (AU:30%),

F4. **Urbaś A.**✉, Augustynek K., Stadnicki J.: Kinetic energy-based indicators to compare different load models of a mobile crane, Materials, 2022. Vol. 15, iss. 22, 1-12, IF_{2022}: 3.748, $MEiN_{2022}$:140pkt., (AU:30%),

F5. Dukalski P, Będkowski B., Parczewski K., Wnęk H., **Urbaś A.**✉, Augustynek K.: Analysis of the influence of motors installed in passenger car wheels on the torsion beam of the rear axle suspension, Energies, 2022, Vol. 15, iss. 1, 1-20, IF_{2022}: 3.252, $MEiN_{2022}$:140pkt., (AU:15%),

F6. Martsenyuk V.✉, Augustynek K., **Urbaś A.**: On qualitative analysis of the nonstationary delayed model of coexistence of two-strain virus: stability, bifurcation, and transition to chaos, International Journal of Non-Linear Mechanics, 2021, 128 IF_{2021}:3.336, $MEiN_{2021}$:100pkt., (AU:30%),

F7. Jarzębowska E.✉, Augustynek K., **Urbaś A.**: Dynamics analysis of a spatial rigid-flexible linkage model subjected to optimized programmed constraints, Mechanics Based Design of Structures and Machines, 2021, 1-15, IF_{2021}: 4.364, $MEiN_{2020}$:70pkt., (AU:30%),

F8. Jarzębowska E., **Urbaś A.**✉, Augustynek K.: Analysis of influence of a crane flexible supports, link flexibility, and joint friction on vibration associated with programmed motion execution, Journal of Vibration Engineering & Technologies, 2020, 8, 337-350, IF_{2020}: 1.889, $MEiN_{2020}$:40pkt., (AU:30%),

F9. **Urbaś A.**✉, Kłosiński J., Augustynek K.: The influence of the PID controller settings on the motion of a truck-mounted crane with a flexible boom and friction in joints, Control Engineering Practice, 2020, 103, 104610, 1-13, IF_{2020}:3.475, $MEiN_{2020}$:100pkt., (AU:30%), F10. Jarzębowska E., Augustynek K., **Urbaś A.**✉: Automated generation of reference dynamical models for constrained robotic systems in the presence of friction and damping effects, Concurrency and Computation: Practice and Experience, Concurrency and Computation: Practice and Experience, 2019, 31(22), 1-10, IF$_{2019}$:1.447, MEiN$_{2020}$:100pkt., (AU:30%),

F11. Dukalski P, Będkowski B., Parczewski K., Wnęk H., **Urbaś A.**✉, Augustynek K.: Dynamics of the vehicle rear suspension system with electric motors mounted in wheels, Maintenance and Reliability, 2019, 21(1), 125-136, IF$_{2019}$:1.525, MEiN$_{2019}$:140pkt., (AU:15%),

F12. **Urbaś A.**✉, Szczotka M.: The influence of the friction phenomenon on a forest crane operators level of discomfort, Maintenance and Reliability, 2019, 21(2), 197-210, IF$_{2019}$:1.525, MEiN$_{2019}$:140pkt., (AU:50%),

F13. Augustynek K., **Urbaś A.**✉: Comparison of bristles friction models in dynamics analysis of spatial linkages, Mechanics Research Communications, 2017, 1-8, IF$_{2017}$:1.640, MNiSW$_{2017}$:30pkt., (AU:50%),

F14. Harlecki A., **Urbaś A.**✉: Modelling friction in the dynamics analysis of selected one-DOF spatial linkage mechanisms, Meccanica, 2017, 52(1-2), 403-420, IF$_{2017}$:2.211, MNiSW$_{2017}$:30pkt., (AU:50%),

F15. **Urbaś A.**✉: Computational implementation of the rigid finite element method in the statics and dynamics analysis of forest cranes, Applied Mathematical Modelling, 2017 Vol. 46,750-762, IF$_{2017}$:2.350, MNiSW$_{2017}$:35pkt.,

F16. **Urbaś A.**✉: Mathematical description of a flexible connection of links and its applications in modeling the joints of spatial linkage mechanisms, Latin American Journal of Solids and Structures, 2016, 13, 2596-2621, IF$_{2016}$:1.106, MNiSW$_{2016}$:20pkt.

F17. **Urbaś A.**✉: Analysis of flexibility of the support and its influence on dynamics of the grab crane, Latin American Journal of Solids and Structures, 2013, 10(1), 109-121, IF$_{2016}$:1.254, MNiSW$_{2016}$:25pkt.,

F18. **Urbaś A.**✉, Szczotka M., Wojciech S.: The influence of flexibility of the support on dynamic behavior of a crane, International Journal of Bifurcation and Chaos, 2011, 21(10), 2963-2974, IF$_{2011}$: 0.755, MNiSW$_{2011}$:20pkt., (AU:30%).

- **papers from outside the JCR list:**
  - **before the doctorate;**

P1. **Urbaś A.**✉, Szczotka M.: Zastosowanie sztucznych sieci neuronowych w doborze funkcji napędowych żurawi na podatnym podłożu, Acta Mechanica et Automatica, Vol. 4, No. 1, 2010, 101-107, MNiSW$_{2010}$:6pkt. (AU:50%),

P2. **Urbaś A.**✉, Adamiec-Wójcik I., Wojciech S.: Dynamics of manipulators fixed on a flexibly supported base. Proc. of ECCOMAS Thematic Conference, Multibody Dynamics 2009, Oficyna Wydawnicza Politechniki Warszawskiej, 2009, (AU:30%),

P3. **Urbaś A.**✉, Wojciech S.: Dynamic analysis of the gantry crane. Problemy Transportu, Wydawnictwo Politechniki Śląskiej, Gliwice 2008, 85-100, MNiSW$_{2008}$:6pkt. (AU:50%),

P4. **Urbaś A.**✉, Wojciech S.: Mathematical model of the crane fixed on a flexibly supported base, Proc. of 10th Conference on Dynamical **Systems** - Theory and Applications DSTA 2007, Vol. 1, 389-395, (AU:50%),

P5. **Urbaś A.**✉: Analiza dynamiczna maszyn roboczych posadowionych podatnie. Materiały I Kongresu Mechaniki Polskiej: KMP 2007, Warszawa, 2007,

P6. **Urbaś A.**✉, Wojciech S.: Analiza dynamiczna żurawia chwytakowego posadowionego podatnie. Zeszyty Naukowe Ośrodka Badawczo-Rozwojowego Samochodów Małolitrażowych BOSMAL, Nr 39, I/2008, 5-16, (AU:50%),

P7. **Urbaś A.**✉, Wojciech S.: Dynamic analysis of the gantry crane used for transporting BOP, Proc. of 9th Conference on Dynamical Systems - Theory and Applications DSTA 2007, Vol. 1, 441-448, (AU:50%),

P8. **Urbaś A.**✉, Harlecki A.: Metoda analizy dynamiki mechanizmu korbowo-suwowego silników spalinowych przy użyciu programu komputerowego MSC.ADAMS/AutoFlex. Czasopismo Techniczne. Mechanika / Politechnika Krakowska, 2006, z.1-M, 401-411, MNiSW$_{2006}$:6pkt, (AU:50%),

  - **after the doctorate;**

P1. Dukalski P.✉, Wolnik T., Będkowski B., Jarek T., **Urbaś A.**, Augustynek K.: Analiza pracy silnika zabudowanego w piaście koła samochodu osobowego dla wybranych parametrów jazdy, Napędy i Sterowanie, 2019, Nr 5, 64-68, MEiN$_{2019}$:5pkt, (AU:15%),

P2. Będkowski B.✉, Dukalski P., Jarek T., Wolnik T., Parczewski K., Wnęk H., **Urbaś A.**, Augustynek K.: Badania prototypowego silnika elektrycznego do zabudowy w kołach samochodu, Maszyny Elektryczne: zeszyty problemowe, 2019: Nr 2 (122), 167-172, MEiN$_{2019}$:5pkt, (AU:10%),

P3. Jarzębowska E.✉, Augustynek K., **Urbaś A.**: Reference dynamics based motion planning for robotic systems with flexible components, Topics in nonlinear mechanics and physics: selected papers from CSNDD 2018, Springer Proceedings in Physics, Vol. 228, 111-123, 2019, MEiN$_{2019}$:20pkt, (AU:30%),

P4. Dukalski P.✉, Będkowski B., Parczewski K., Wnęk H., **Urbaś A.**, Augustynek K.: Wybrane aspekty mechaniczne samochodu napędzanego silnikami elektrycznymi wbudowanymi w piastach kół, Maszyny Elektryczne: zeszyty problemowe, 2019, nr 2 (122), 173-178, MEiN$_{2019}$:5pkt, (AU:15%),

P5. Dukalski P.✉, Będkowski B., **Urbaś A.**, Augustynek K., Parczewski K., Wnęk H.: Analiza dynamiki tylnego układu zawieszenia pojazdu osobowego z napędami elektrycznymi wbudowanymi w koła, Modelowanie Inżynierskie, 2018, T. 37, Nr 68, 32-37, MNiSW$_{2018}$:8pkt, (AU:15%),

P6. Dukalski P.✉, Wolnik T., Będkowski B., Jarek T., **Urbaś A.**, Augustynek K.: Analiza pracy silnika zabudowanego w piaście koła samochodu osobowego dla wybranych parametrów jazdy, Maszyny Elektryczne: zeszyty problemowe, 2018, Nr 1 (117), 69-74, MNiSW$_{2018}$:7pkt, (AU:15%),

P7. Dukalski P.✉, Będkowski B., Parczewski K., Wnęk H., **Urbaś A.**, Augustynek K.: Analysis of the influence of assembly electric motors in wheels on behaviour of vehicle rear suspension system, IOP Conference Series: Materials Science and Engineering, 2018, Vol. 421, Article Number: 022004, 1-9, MNiSW$_{2018}$:15pkt, (AU:15%),

P8. Dukalski P.✉, Będkowski B., Parczewski K., Wnęk H., **Urbaś A.**, Augustynek K.: Model symulacyjny dynamiki tylnego zawieszenia samochodu typu Fiat Panda z zabudowanymi silnikami elektrycznymi w obręczach kół, Maszyny Elektryczne : zeszyty problemowe, 2018, Nr 1 (117), 75-80, MNiSW$_{2018}$:7pkt, (AU:15%),

P9. Jarzębowska E.✉, Augustynek K., **Urbaś A.**: Planning task-based motions of multi-link manipulator models prone to vibration, Vibrations in Physical Systems, 2018, Vol. 29, May 2018, Article number 2018029, 1-9, MNiSW$_{2018}$:5pkt, (AU:30%),

P10. Jarzębowska E.✉, Augustynek K., **Urbaś A.**: Programmed task based motion analysis of robotic systems equipped with flexible links and supports, MATEC Web of Conferences, 2018, Vol. 241, Article Number 01008, 1-4, MNiSW$_{2018}$:15pkt (AU:30%), P11. Jarzębowska E.✉, Augustynek K., **Urbaś A.**: Vibration of a crane system model equipped with flexible links in the presence of kinematic task-based constraints, MATEC Web of Conferences, 2018, Vol. 211, Article Number 03006, 1-6, MNiSW$_{2018}$:15pkt (AU:30%),

P12. Dukalski P.✉, Będkowski B., Wolnik T., **Urbaś A.**, Augustynek K.: Założenia projektu silnika do zabudowy w piaście koła samochodu elektrycznego, Maszyny Elektryczne: zeszyty problemowe, 2017, Nr 2(114), 263-272, MNiSW$_{2017}$:7pkt, (AU:20%),

P13. **Urbaś A.**, Harlecki A.: Analiza dynamiki żurawia chwytakowego z uwzględnieniem modelu tarcia LuGre w przegubach, Problemy rozwoju maszyn roboczych, 2016, 1-20, (AU:50%),

P14. **Urbaś A.**✉: Application of the Dahl friction model in the dynamics analysis of grab cranes, MATEC Web Conferences, 2016, Vol. 83, Article Number 03008, 1-4, MNiSW$_{2016}$:15pkt,

P15. Harlecki A., **Urbaś A.**✉: Dynamic analysis of a selected spatial one-DOF linkage mechanism with friction in joints, Journal of Control Science and Engineering, 2016: Vol. 4, No. 1, 11-25, MNiSW$_{2016}$:5pkt, (AU:50%),

P16. **Urbaś A.**✉, Stanclik G., Kłosiński J., Harlecki A.: Dynamics analysis of a truck-mounted crane with the LuGre friction model in the joints, Vibrations in Physical Systems, 2016: Vol. 27, 391-398, MNiSW$_{2016}$:5pkt, (AU:25%),

P17. Harlecki A., **Urbaś A.**✉: Dynamics analysis of the RUSP linkage with joint friction modelled by the Stribeck effect, Advances in mechanics : theoretical, computational and interdisciplinary issues: Proc. of the 3rd Polish Congress of Mechanics (PCM) & 21st International Conference on Computer Methods in Mechanics (CMM) - PCM-CMM-2015 Congress, Gdańsk, Poland, 8-11 September 2015, MNiSW$_{2016}$:15pkt, (AU:50%),

P18. **Urbaś A.**✉, Szczotka M.: Modelling friction phenomena in the dynamics analysis of forest cranes, Engineering Transactions = Rozprawy Inżynierskie, 2016, Vol. 64, No. 4, 393-400, MNiSW$_{2015}$:15pkt, (AU:50%),

P19. Harlecki A., **Urbaś A.**✉: Metoda analizy dynamiki wybranej klasy przestrzennych mechanizmów dźwigniowych z uwzględnieniem tarcia, Materiały XI Konferencji Nowe Kierunki Rozwoju Mechaniki, Koszalin-Sarbinowo, 18-20 marca 2015, 37-38, (AU:50%),

P20. Harlecki A., **Urbaś A.**✉, Nowakowski J., Byrski A.: Analiza dynamiki układu tłokowo-korbowego wybranego silnika spalinowego przy użyciu interfejsu programów MSC.ADAMS i ANSYS, Combustion Engines = Silniki Spalinowe, 2013, Nr 3 (154), 1076-1083, ,MNiSW$_{2013}$:7pkt, (AU:25%),

4.2. Participation in national and international congresses and conferences

- **Participation in national and international congresses:**
  - **before the doctorate;**

C1. **Urbaś A.**: Analiza dynamiczna maszyn roboczych posadowionych podatnie. I Kongres Mechaniki Polskiej: KMP 2007, Warszawa, 2007,

  - **after the doctorate;**

C1. Jarzębowska E., Augustynek K., **Urbaś A.**: Tracking task based motions for robotic systems using the method of computationally generated constrained dynamics, 4th Polish Congress of Mechanics and 23rd International Conference on Computer Methods in Mechanics PCM-CMM-2019, Kraków, Poland, 2019,

C2. Jarzębowska E., Augustynek K., **Urbaś A.**: Vibration of a planar linkage structure with flexible support subjected to kinematic task based constraints, 15th World Congress on Mechanism and Machine Science, Kraków, Poland, 2019,

C3. **Urbaś A.**, Augustynek K.: Modelling of the dynamics of grab cranes with a complex kinematic structure, taking into account the links' flexibility and advanced friction models, 13th World Congress on Computational Mechanics (WCCM XIII) and 2nd Pan American Congress on Computational Mechanics (PANACM II), New York, USA, 2018,

C4. Harlecki A., **Urbaś A.**: Dynamics analysis of the RUSP linkage with joint friction modelled by the Stribeck effect, 3rd Polish Congress of Mechanics (PCM) and 21st International Conference on Computer Methods in Mechanics (CMM), Gdańsk, Poland, 2015.

- **Participation in national and international conferences:**
  - **before the doctorate;**

K1. Drewniak J., Augustynek K., **Urbaś A.**: Wdrożenie analizy modalnej do ćwiczeń laboratoryjnych z PKM. XXI Sympozjon Podstaw Konstrukcji Maszyn, Ustroń, 2003,

K2. Drewniak J., Augustynek K., Mendrok K., **Urbaś A.**: Ćwiczenia dydaktyczne z analizy modalnej. VIII Szkoła Analizy Modalnej, Kraków 2003,

K3. **Urbaś A.**, Harlecki A.: Metoda analizy dynamiki mechanizmu korbowo-suwowego silników spalinowych przy użyciu programu komputerowego MSC.ADAMS/AutoFlex. XIX Konferencja PRMR, Zakopane, 2006, K4. Augustynek K., **Urbaś A.**, Harlecki A.: Wpływ podatności członów i tarcia suchego na dynamikę ruchu płaskich mechanizmów dźwigniowych. XX Konferencja Naukowo-Dydaktyczna Teorii Maszyn i Mechanizmów, Zielona Góra, 2006,

K5. **Urbaś A.**, Wojciech S.: Dynamic analysis of the gantry crane used for transporting BOP. 9th Conference on Dynamical Systems-Theory and Applications DSTA2007, Łódź, 2007,

K6. **Urbaś A.**, Augustynek K., Sidzina M., Janusz J.: Badania doświadczalne uproszczonego modelu żurawia chwytakowego. XXI Konferencja Teorii Maszyn i Mechanizmów-Szczyrk, 2008,

K7. **Urbaś A.**, Wojciech S.: Dynamic analysis of the gantry crane. Proc. of VIII Scientific Conference - Telematics, Logistics and Transport Safety, Katowice-Cieszyn, 2008,

K8. **Urbaś A.**, Adamiec-Wójcik I., Wojciech S.: Dynamics of manipulators fixed on a flexibly supported base. ECCOMAS Thematic Conference, Multibody Dynamics 2009, Warsaw, 2009,

K9. **Urbaś A.**, Wojciech S.: Mathematical model of the crane fixed on a flexibly supported base, 10th Conference on Dynamical Systems-Theory and Applications DSTA2009, Łódź, 2009,

K10. **Urbaś A.**, Szczotka M.: Zastosowanie sztucznych sieci neuronowych w doborze funkcji napędowych żurawi na podatnym podłożu, XXII Konferencja Naukowo-Dydaktyczna Teorii Maszyn i Mechanizmów, Augustów, 2010.

- **after the doctorate;**

K1. **Urbaś A.,** Augustynek K., Stadnicki J.: Kinetic energy based indicators to compare different load models of a mobile crane, VIBSYS 2022 Poznań: XXX Conference "Vibrations in physical systems", Poznań, Poland, 2022,

K2. Augustynek K., **Urbaś A.,** Stadnicki J.: Study of the clearance effect in revolute and prismatic joints on the dynamics of a spatial mechanism with flexible link, VIBSYS 2022 Poznań: XXX Conference "Vibrations in physical systems", Poznań, Poland, 2022,

K3. Jarzębowska E., Augustynek K., **Urbaś A.**: Motion tracking of a rigid-flexible link robotic system in an underactuated control mode, 7th European Conference on Structural Control (EACS 2022), Warsaw, Poland, 2022,

K4. **Urbaś A.,** Augustynek K., Martsenyuk V.: The influence of the load modeling methods on dynamics of a mobile crane, 16th Conference on Dynamical Systems Theory and Applications; DSTA 2021, Łódź, Poland, 2021, K5. Augustynek K., **Urbaś A.**, Martsenyuk V.: Dynamics analysis of the spatial mechanism with imperfections in the fifth-class kinematic pairs, 16th Conference on Dynamical Systems Theory and Applications; DSTA 2021, Łódź, Poland, 2021,

K6. Martsenyuk V., Augustynek K., **Urbaś A.**: On qualitative analysis of the model of two-link manipulator with time delays: stability, birufication and transition to chaos, 16th Conference on Dynamical Systems Theory and Applications; DSTA 2021, Łódź, Poland, 2021,

K7. Jarzębowska E., Augustynek K., **Urbaś A.**: Motion tracking of rigid-flexible link manipulator in a controller failure condition, 16th Conference on Dynamical Systems Theory and Applications; DSTA 2021, Łódź, 2021,

K8. Augustynek K., **Urbaś A.**: Analysis of the influence of the links flexibility and clearance effects on the dynamics of the RUSP linkage, 9th ECCOMAS thematic conference on Multibody Dynamics, Duisburg, Germany, 2019,

K9. **Urbaś A.**, Augustynek K.: Mathematical model of a crane with taking into account friction phenomena in actuators, 9th ECCOMAS thematic conference on Multibody Dynamics, Duisburg, Germany, 2019,

K10. Dukalski P., Wolnik T., Będkowski B., Jarek T., **Urbaś A.**, Augustynek K.: Analiza pracy silnika zabudowanego w piaście koła samochodu osobowego dla wybranych parametrów jazdy, XXVIII Konferencja Naukowo-Techniczna "Problemy Eksploatacji Maszyn i Napędów Elektrycznych"; PEMINE 2019, Rytro, Poland, 2019,

K11. Będkowski B., Dukalski P., Jarek T., Wolnik T., Parczewski K., Wnęk H., **Urbaś A.**, Augustynek K.: Badania prototypowego silnika elektrycznego do zabudowy w kołach samochodu, XXVIII Konferencja Naukowo-Techniczna "Problemy Eksploatacji Maszyn i Napędów Elektrycznych"; PEMINE 2019, Rytro, Poland, 2019,

K12. Dukalski P., Będkowski B., Parczewski K., Wnęk H., **Urbaś A.**, Augustynek K.: Wybrane aspekty mechaniczne samochodu napędzanego silnikami elektrycznymi wbudowanymi w piastach kół, XXVIII Konferencja Naukowo-Techniczna "Problemy Eksploatacji Maszyn i Napędów Elektrycznych"; PEMINE 2019, Rytro, Poland, 2019,

K13. Jarzębowska E., Augustynek K., **Urbaś A.**: Dynamics and vibration analysis of a spatial linkage model with flexible links and joint friction subjected to position and velocity motion constraints, 15th International Conference Dynamical Systems - Theory and Applications; DSTA 2019, Łódź, Poland, 2019, K14. **Urbaś A.**, Augustynek K.: Evaluation of the crane's actuators strength based on the results obtained from dynamics model, 15th International Conference Dynamical Systems - Theory and Applications; DSTA 2019, Łódź, Poland, 2019,

K15. Augustynek K., **Urbaś A.**: The dynamics analysis of a spatial linkage with flexible links and imperfect revolute joints, 15th International Conference Dynamical Systems - Theory and Applications; DSTA 2019, Łódź, Poland, 2019,

K16. Jarzębowska E., Augustynek K., **Urbaś A.**: Reference dynamics based motion planning for robotic systems with flexible components, 4th International Conference on Structural Nonlinear Dynamics and Diagnosis 2018, Tangier, Marocco, 2018,

K17. Augustynek K., **Urbaś A.**: Mathematical modelling of spatial linkages with clearance, friction and links' flexibility effects, 5th Joint International Conference on Multibody System Dynamics, Lisbon, Portugal, 2018,

K18. Dukalski P., Będkowski B., **Urbaś A.**, Augustynek K., Parczewski K., Wnęk H.: Analiza dynamiki tylnego układu zawieszenia pojazdu osobowego z napędami elektrycznymi wbudowanymi w koła, Sympozjon „Modelowanie w mechanice", Ustroń, Poland, 2018,

K19. Dukalski P., Wolnik T., Będkowski B., Jarek T., **Urbaś A.**, Augustynek K.: Analiza pracy silnika zabudowanego w piaście koła samochodu osobowego dla wybranych parametrów jazdy, XXVII Konferencja Naukowo-Techniczna "Problemy Eksploatacji Maszyn i Napędów Elektrycznych"; PEMINE 2018, Rytro, Poland, 2018,

K20. Dukalski P., Będkowski B., Parczewski K., Wnęk H., **Urbaś A.**, Augustynek K.: Model symulacyjny dynamiki tylnego zawieszenia samochodu typu Fiat Panda z zabudowanymi silnikami elektrycznymi w obręczach kół, XXVII Konferencja Naukowo-Techniczna "Problemy Eksploatacji Maszyn i Napędów Elektrycznych"; PEMINE 2018, Rytro, Poland, 2018,

K21. Dukalski P., Będkowski B., Parczewski K., Wnęk H., **Urbaś A.**, Augustynek K.: Analysis of the influence of assembly electric motors in wheels on behaviour of vehicle rear suspension system, KONMOT - 2018 : Scientific automotive conference, Kraków, Poland, 2018,

K22. Jarzębowska E., Augustynek K., **Urbaś A.**: Planning task-based motions of multi-link manipulator models prone to vibration, XXVIII Symposium Vibrations in Physical Systems, Będlewo-Poznań, Poland, 2018, K23. Jarzębowska E., Augustynek K., **Urbaś A.**: Development of a computational based reference dynamics model of a flexible link manipulator, 14th International Conference Dynamical Systems - Theory and Applications; DSTA 2017, Łódź, Poland, 2017,

K24. Jarzębowska E., **Urbaś A.**, Augustynek K.: Computational based constrained dynamics generation for a model of a crane with compliant support, 14th International Conference Dynamical Systems - Theory and Applications; DSTA 2017, Łódź, Poland, 2017,

K25. **Urbaś A.**, Jabłoński A., Kłosiński J., Augustynek K.: Dynamics and control of a truck-mounted crane with a flexible jib, 14th International Conference Dynamical Systems - Theory and Applications; DSTA 2017, Łódź, Poland, 2017,

K26. Jarzębowska E., Augustynek K., **Urbaś A.**: Computational reference dynamical model of a multibody system with first order constraints, SME 2017 International Design Engineering Technical Conferences and Computers and Information in Engineering Conference : 13th International Conference on Multibody Systems, Nonlinear Dynamics and Control, Cleveland, USA, 2017,

K27. **Urbaś A.**, Jabłoński A., Kłosiński J.: Dynamics of a truck-mounted crane when taking into account the flexibility of the hoist system and friction, XXX Konferencja PRMR, Zakopane, Poland, 2017,

K28. Augustynek K., **Urbaś A.**: Two approaches of the rigid finite element method to modelling the flexibility of spatial linkage links, 8th ECCOMAS Thematic Conference on Multibody Dynamics 2017, Praha, Czech Republic, 2017,

K29. Dukalski P., Będkowski B., Wolnik T., **Urbaś A.**, Augustynek K.: Założenia projektu silnika do zabudowy w piaście koła samochodu elektrycznego, XXVI Konferencja Naukowo-Techniczna "Problemy Eksploatacji Maszyn i Napędów Elektrycznych"; PEMINE 2017, Rytro, Poland, 2017,

K30. **Urbaś A.**, Harlecki A.: Application of the Dahl friction model in the dynamics analysis of grab cranes, 3th International Conference on Structural Nonlinear Dynamics and Diagnosis 2017, Marakech, Marocco, 2017,

K31. **Urbaś A.**, Harlecki A.: Analiza dynamiki żurawia chwytakowego z uwzględnieniem modelu tarcia LuGre w przegubach, XXIX Konferencja PRMR, Zakopane, Poland, 2016,

K32. **Urbaś A.**, Jabłoński A., Kłosiński J.: Application of the LuGre friction model in the dynamics analysis of a truck-mounted crane with a flexible link, 40th Solid Mechanics Conference; SolMech 2016, Warszawa, Poland, 2016, K33. **Urbaś A.**, Harlecki A.: Application of the rigid finite element method and the LuGre friction model in the dynamics analysis of grab cranes, 4th Joint International Conference on Multibody System Dynamics; IMSD 2016, Montreal, Canada, 2016,

K34. **Urbaś A.**, Stanclik G., Kłosiński J., Harlecki A.: Dynamics analysis of a truck-mounted crane with the LuGre friction model in the joints, XXVII Symposium Vibrations in Physical Systems, Będlewo-Poznań, Poland, 2016,

K35. **Urbaś A.**, Szczotka M.: Modelling friction phenomena in the dynamics analysis of forest cranes, 40th Solid Mechanics Conference; SolMech 2016, Warszawa, Poland, 2016,

K36. Harlecki A., **Urbaś A.**: Application of Dahl friction model in dynamic analysis of spatial linkages, 7th International Conference on Vibration Engineering; ICVE 2015, Shanghai, China, 2015,

K37. **Urbaś A.**: Application of the Rigid Finite Element Method in the dynamics of grab cranes, 13th International Conference Dynamical Systems - Theory and Applications; DSTA 2015, Łódź, Poland, 2015,

K38. Harlecki A., **Urbaś A.**: Dynamics simulations of spatial linkages using the LuGre friction model, 13th International Conference Dynamical Systems - Theory and Applications; DSTA 2015, Łódź, Poland, 2015,

K39. Harlecki A., **Urbaś A.**: Forward dynamics of selected spatial one-dof linkage mechanisms with the Dahl friction model in revolute joints, ECCOMAS Thematic Conference on Multibody Dynamics 2015, Barcelona, Spain, 2015,

K40. Harlecki A., **Urbaś A.**: Metoda analizy dynamiki wybranej klasy przestrzennych mechanizmów dźwigniowych z uwzględnieniem tarcia, XI Konferencja Nowe Kierunki Rozwoju Mechaniki, Koszalin-Sarbinowo, Poland, 2015,

K41. Harlecki A., **Urbaś A.**: Modelling friction phenomena in dynamic analysis of spatial linkages, 56th International Conference of Machine Design Departments; ICMD 2015, Nitra, Slovakia, 2015,

K42. **Urbaś A.**, Harlecki A.: A dynamic analysis of the selected class of spatial one-dof linkage mechanisms, 12th International Conference Dynamical Systems - Theory and Applications; DSTA 2013, Łódź, Poland, 2013,

K43. Harlecki A., **Urbaś A.**, Nowakowski J., Byrski A.: Analiza dynamiki układu tłokowo-korbowego wybranego silnika spalinowego przy użyciu interfejsu programów MSC.ADAMS i ANSYS, V Międzynarodowy Kongres Silników Spalinowych, Bielsko-Biała, Poland, 2013, K44. **Urbaś A.**: Dynamics of grab cranes with flexibly supported base, 11th International Conference Dynamical Systems - Theory and Applications; DSTA 2011, Łódź, Poland, 2011.

In Tabs 1 and 2 present a numerical summary and bibliometric indicators of publications.

Tab. 1. Numerical summary

	before the doctorate		after the doctorate	
	in Polish	in English	in Polish	in English
monograph, script	1	-	1	1
chapter in a monograph	3	3	-	18
papers from the JCR list	-	1	-	18
papers from outside the JCR list	4	4	10	10
abstract 1 or 2 pages (reviewed)	-	2	-	24
papers at congresses and conferences	6	4	10	34

Tab. 2. Bibliometric indicators

		before the doctorate	after the doctorate
IF	total value/ without co-author(s)	0.264/0.088	46.063/17.468
MNiSW MEiN	total value/ without co-author(s)	34/15.5	416/215 1665/644
WoS	number of citations/ no self-citations	4/4	76/57
	Hirsh index	1	5
Scopus	number of citations/ no self-citations	1/0	124/82
	Hirsh index	0	7

5. Information on demonstrating significant scientific or artistic activity carried out in more than one university, scientific or cultural institution, in particular a foreign one.

5.1. Participation in scientific and research projects carried out at the University of Bielsko-Biala

In 2005-2011 I took part in scientific project

G1. Computer implementation of the joint coordinates and homogeneous transformations for modelling multibody systems (NCN project: 4 T07A 049 28, 2005-2007, project manager: Adamiec-Wójcik I.) – Urbaś A. team member,

and research project

G2. Development of new designs of purification systems and collecting electrodes for electrostatic precipitators (NCBiR project: NR03-0035-04, 2008-2011, project manager: Adamiec-Wójcik I.) - Urbaś A. team member.

My role in the above projects consisted of:

- development of the mathematical model;

I developed a mathematical model of the grab crane with taking into account of the flexible supported base.

- performing experimental research to verify mathematical models;

I prepared a test stand to verify the mathematical models of flexibly supported cranes.

I performed (together with Prof. A. Nowak) acceleration measurements on electrostatic precipitator electrodes at the test stand in Elwo in Pszczyna and at the Bydgoszcz Heat and Power Plant facility.

- preparation of the monograph;
  - ✓ Wojciech S.: Application of joint coordinates and homogeneous transformations in vehicle dynamics modelling, Scientific Journals / Research and Development Center for Small Engine Vehicles BOSMAL, Bielsko-Biala, 2007 (in Polish),

5.2. Scientific activity - directions of scientific research and scientific projects carried out in cooperation with other scientists, universities and national research centers

In 2004-2011 I took part in two scientific projects:

G3. Rigid finite element method in modelling the dynamics of multi-body systems (NCN project: 4 T07B 040 27, 2004-2006, project manager: Wittbrodt E., Gdańsk University of Technology) – Urbaś A. team member, G4. Development of the rigid finite element method and its application in the design of offshore equipment (NCN project: N N502 46 49 34, 2008-2011, project manager: Wittbrodt E., Gdańsk University of Technology) – Urbaś A. team member,

My role in the above projects consisted of:

- ➢ development of the mathematical model;

In cooperation with the PROTEA company, I have prepared a mathematical model of a BOP crane with a lifting capacity of 550T.

- ➢ preparation of monographs;
  - ✓ Wittbrodt E., Adamiec-Wójcik I., Wojciech S.: Dynamics of flexible multibody systems. Rigid Finite Element Method, Springer, Berlin, 2006,
  - ✓ Adamiec-Wójcik I., Maczyński A., Wojciech S.: Application of the homogeneous transformations in modelling the dynamics of offshore devices, Transport and Communication Publishers, Warsaw, 2008 (in Polish),
  - ✓ Wittbrodt E., Szczotka M., Maczyński A., Wojciech S.: Rigid Finite Element Method in analysis of dynamics of offshore structures, Heidelberg, Springer-Verlag, Berlin, 2013.

- ➢ After obtaining my doctorate, I started my independent research focused on further development of methods for modelling multibody systems, including manipulators, mechanisms and cranes.

Within this work:

- ✓ 6 papers published (R13, R18, F12, F15, F16, F17),
- ✓ 2 papers presented at international conferences (K37, K44).

- ➢ In 2013-2016 I worked with Prof. A. Harlecki (University of Bielsko-Biala) in the scope of taking into account the phenomenon of friction in kinematic pairs in the developed mathematical models of mechanisms and cranes.

Within this cooperation:

- ✓ 11 papers published (R12, R14-R17, F14, P13, P15, P16, P17, P19),
- ✓ 12 papers were presented at national and international congresses and conferences (C1, K30-K34, K36, K39-K43).

- The research presented at the 13th International Conference Dynamical Systems - Theory and Applications; DSTA 2015, Łódź, Poland, 2015 resulted in establishing cooperation with Prof. E. Jarzębowska (Warsaw University of Technology). In 2016, we started the work on the development of a general algorithm for formulating dynamics equations with first-order programmed constraints using the formalism of joint coordinates and homogeneous transformation matrices. In 2016, as part of this cooperation, the "Mechatronics and Control" session was organized during the International Design Engineering Technical Conferences & Computers and Information in Engineering Conference (IDETC/CIE 2017) - 13th International Conference on Multibody Systems, Nonlinear Dynamics, and Control (MSNDC) - August 6-9, 2017, Cleveland, Ohio, USA.

Achievements in the field of this cooperation are presented in the further part of the professional accomplishments.

- In 2016, I also established cooperation with MSc. P. Dukalski from the Institute of Electrical Drives and Machines KOMEL (student of doctoral studies at the Faculty of Mechanical Engineering and Computer Science of the University of Bielsko-Biala, participant of my lectures on "Programming in the construction and operation of machines") in the field of developing a mathematical model of the rear suspension system of a passenger car, with drives in the form of twomotors mounted in the wheel hubs. I became a team member of the research project:

G5. Innovative solutions for direct drives of electric vehicles (NCBiR project: LIDER/4/0082/L-7/15/NCBR/2016, 2016-2019, project manager: Dukalski P.) - Urbaś A. team member, which was realized by KOMEL.

As part of this project, the KOMEL team built a prototype motor that has been awarded many times (including the Polish Intelligent Development Award, the Siemens Award).
In this project, I was responsible for the research work entitled "Performing kinematic and dynamic simulations of motor models for installation in the wheel hub of an electric vehicle". In 2017 and 2018, UBB employees were added to this work and the scope of work was extended to include experimental research. The results of these studies are presented in the further part of the professional accomplishments.

- In 2017, I established a research team: Krzysztof Augustynek, PhD. and Andrzej Urbaś PhD., whose goal is to develop methods for modelling the dynamics of multibody systems, taking into account various phenomena such as: flexibility of the supported base, link flexibility and imperfections in joint (friction, clearance).

The study of dynamics is focused on the following multibody systems:

- cranes– team leader: Andrzej Urbaś, PhD.;

As part of modelling the dynamics of cranes, the team is developing general algorithms for generating dynamics equations, taking into account the tree structure of the kinematic chain. When formulating the model, phenomena such as: support system flexibility, supporting structure flexibility and friction in joints are taken into account.

Within this scope, the team:

- ✓ received a research project,

G6. Modeling of multibody systems with a complex kinematic structure, taking into account the flexibility of links and advanced friction models for dynamics and control analysis (NCN project: 2017/01/X/ST8/01456/2018, 2018 – project manager: Urbaś A.)

- ✓ 5 papers published (R2, R4, R9, F4, F9),
- ✓ 6 papers were presented at national and international congresses and conferences (C3, K1, K4, K9, K14, K25).

- mechanisms and manipulators – leader: Krzysztof Augustynek, PhD.;

As part of modelling the dynamics of mechanisms and manipulators, the team is developing general mathematical models that take into account large deformations of flexible links and imperfections in joints such as friction and clearance. It is assumed that the mechanism topology can be tree-like with loops.

Within this scope, the team:

- ✓ received a research project,

G7. Development of clearance and friction models in joints of spatial mechanisms with flexible links for dynamics and control analysis (NCN: 2017/01/October/ST8/01978, 2018) - project manager: Augustynek K.

- ✓ 5 papers published (R1, R3, R11, F2, F13),
- ✓ 6 papers were presented at national and international congresses and conferences (K2, K5, K8, K15, K17, K28).

- mechanical systems with programmed constraints - leader: Prof. Elizabeth Jarzębowska;

As part of modelling the dynamics of cranes, mechanisms and manipulators, the team is developing general mathematical models taking into account first-order programmed constraints.

Within this scope, the team:

✓ 12 papers published (R5-R8, F1, F3, F7, F8, F10, P3, P10, P11),

✓ 10 papers were presented at national and international congresses and conferences (C1, C2, K3, K7, K13, K16, K22, K23, K24, K26).

- suspension of vehicles withmotors built into the wheel hub - leader: Andrzej Urbaś, PhD. (since 2018 Prof. Krzysztof Parczewski);

As part of modelling vehicle dynamics, the team is developing mathematical models of the rear suspension system, with the drives in the form of two motors mounted in the wheel hubs. Research focuses on assessing the influence of unsprung masses on vehicle controllability.

In order to experimentally verify the mathematical models developed, in 2018, the team invited to the cooperation Prof. Krzysztof Parczewski and Henryk Wnęk, PhD. from the Department of Combustion Engines and Vehicles of the UBB.

Within this scope, the team:

✓ 10 papers published (F5, F10, P1, P2, P4-P8, P12),

✓ 10 papers were presented at national and international congresses and conferences (K10-K12, K18-K21, K29).

5.3. Scientific activity - directions of scientific research carried out in cooperation with other scientists, universities and research centers abroad

Scientific research conducted and presented at international conferences (especially ECCOMAS Thematic Conference on MULTIBODY DYNAMICS (2015, 2017, 2019) and Joint International Conference on Multibody System Dynamics (2016, 2018) as well as meetings (online - during the pandemic) resulted in establishing international cooperation with scientists from:

✓ University of West Bohemia, Plzen, Czech Republic - prof. Michal Hajžman, dr Miroslav Byrtus, dr Radek Bulín,

✓ Research and Testing Institute, Plzen, Czech Republic – prof. Pavel Polach,

- ✓ Czech Technical University, Praha, Czech Republic – prof. Zbyněk Šika , dr Petr Beneš, dr Jan Zavřel, prof. Michael Valášek, dr Karel Kraus

and preparation of international projects:

G8. Modelling and suppression of effects of joints imperfections and friction in mechatronic systems (project NCN, CEUS-UNISONO, 2020/02/Y/ST8/00044, project manager Hajžman M., leader of Polish team: Urbaś A.), 04.2020,

G9. Elimination of the influence of joints' imperfections on the dynamics of mechatronic (project NCN, OPUS LAP, 2020/39/I/ST8/01430, project manager Urbaś A., leader of Czech team: Hajžman M.), 11.2020,

G10. Elimination of the influence of joints' imperfections on the dynamics of mechatronic systems (project NCN, WEAVE-UNISONO, 2021/03/Y/ST8/00063 project manager Hajžman M., leader of Polish team: Urbaś A.), 04.2021.

Prof. Jacek Stadnicki (ATH), a specialist in formulating optimization problems and algorithms for effective solution of optimization tasks was attached to the team.

The projects passed the stage of preliminary assessment but were not qualified for financing.

6. Information on didactic, organizational and popularizing science or art achievements.

6.1. Teaching achievements

6.1.1. Conducting classes at first, second and third degree studies

I was teaching classes:

- **before the doctorate:**

Field	Degree	Form	Subject
Mechanical Engineering	II (MSc.)	full-time studies	Mechanics (Ex.), Numerical methods (Lab.), Computer aided machines modelling (Lab.), Machines dynamics (Lab.)
	I (Eng.).	evening studies	Technical mechanics (Ex.), Numerical methods (Lab.), Machines dynamics (Lab.)
Automation and Robotics	I (Eng.)	full-time studies	Fundamentals of mechanics (Ex.), Fundamentals of robotics I (Ex.), Fundamentals of robotics II (Ex.), Robots dynamics (Ex.), Manipulator dynamics (Ex.), Modelling of dynamic systems (Ex.)
		evening studies	Fundamentals of mechanics (Ex.), Fundamentals of robotics I (Ex.), Fundamentals of robotics II (Ex.), Robots dynamics (Ex.), Manipulator dynamics (Ex.)

Transport	I (Eng.)	full-time studies	Fundamentals of mechanics I (Ex.), Fundamentals of mechanics II (Ex.), Fundamentals of mechanics III (Ex.)
		external studies	Fundamentals of mechanics I (Ex.), Fundamentals of mechanics II (Ex.), Fundamentals of mechanics III (Ex.)
Computer Science	I (Eng.).	full-time studies	Office programs (Lab.)
		evening studies	
Emergency medical services	I (B.)	full-time studies	
Nursing	I (B.)	full-time studies	
Polish studies	I (B.)	full-time studies	
Slavic studies	I (B.)	full-time studies	

- **after the doctorate:**

Field of study	Degree	Form	Subject
Mechanical Engineering	III (PhD.)	full-time studies	Programming in the construction and operation of machines (Lab.), Modelling of systems and structures II (Lab.)
Mechanical Engineering	II (MSc.)	full-time studies	Discrete fluid mechanics (L., Ex.), Experimental analysis of the structure (L., Ex.), Computer aided mechatronics system modelling (Lab.)
		evening studies	
	I (Eng.)	full-time studies	Technical mechanics (Ex.), Numerical methods (Lab.), Machines dynamics (L., Lab.), Fundamentals of construction and operation of machines (Lab.)
		evening studies	
Mechatronics	II (MSc.)	full-time studies	Computer aided mechatronics system modelling (Lab.)
		evening studies	Computer aided mechatronics system modelling (Lab.)
	I (Eng.)	full-time studies	Introduction to mechatronics (L., Lab.), Mechatronics (L., Ex.), Numerical methods (L., Lab.), Field methods (L., Lab.), Dynamics and control of robots (L., Lab.), Computer aided mechatronics (L., Lab.), Engineering calculations (L., Lab.)
		external studies	Introduction to mechatronics (L., Lab.), Mechatronics (L., Ex.), Numerical methods (L., Lab.), Field methods (L., Lab.), Dynamics and control of robots (L., Lab.), Computer aided

			mechatronics (L., Lab.), Engineering calculations (L., Lab.)
Civil Engineering	II (MSc.)	full-time studies	Finite element method (L., Lab.)
		external studies	Finite element method (L., Lab.)
	I (Eng.)	full-time studies	Technical mechanics (L., Ex.), Engineering calculations (Lab.), Structural mechanics I (Ex.)
		external studies	Theoretical Mechanics (L., Ex.), Engineering calculations (Lab.), Structural mechanics I (Ex.)
Automation and Robotics	I (Eng.)	full-time studies	Fundamentals of mechanics (Ex.), Robots dynamics (L., Ex.), Application of computer techniques in mechanics (L., Ex.), Fundamentals of computer architecture (Lab.), Databases (Lab.), Programming I (Lab.), Operational systems (Lab.),
		evening studies	Fundamentals of mechanics (Ex.), Fundamentals of robotics I (Ex.), Fundamentals of robotics II (Ex.), Robots dynamics (L.), Application of computer techniques in mechanics (Lab.)
Computer Science	I (Eng.)	full-time studies	Numerical methods (w., Lab.)
		external studies	
General (dedicated for ERASMUS+ Students)	I (Eng.)	full-time studies	Dynamics of machines (Lab.), Fundamentals of robotics (Lab.), Numerical methods for engineers (Lab.), Simulations of dynamical systems (Lab.)

6.1.2. Opracowanie programu przedmiotu

Field of study	Degree	Subject
Mechanical Engineering	III (PhD.)	Programming in the construction and operation of machines (Lab.)
Mechanical Engineering	II (MSc.)	Computer aided mechatronics system modelling (Lab.) (with K. Augustynek) , Computer aided engineering calculations (L., Lab.) (with K. Augustynek), Digital twin technologies (P.) (with K. Augustynek),
	I (Eng.)	Technical Mechanics (Ex.), Numerical methods (Lab.), Machines dynamics (L., Lab.), Fundamentals of construction and operation of machines (Lab.), Simulation and control of the motion of 3D printing devices (L., Ex.) (with K. Augustynek), Industry 4.0 (L.) (with K. Augustynek),

Mechatronics	II (MSc.)	Computer aided mechatronics system modelling (L.) (with K. Augustynek) Theory of mechanisms and machines (L., P.)
	I (Eng.)	Introduction to mechatronics (L., Lab.), Mechatronics (L., Ex.), Numerical methods (L., Lab.), Field methods (L., Lab.), Dynamics and control of robots (L., Lab.), Computer aided mechatronics (L., Lab.), Engineering calculations (L., Lab.)
Civil Engineering	II (MSc.)	Finite element method (Lab.) (with K. Augustynek)
	I (Eng.)	Theoretical Mechanics (L. Ex.)
Automation and Robotics	I (Eng.)	Robots dynamics (L., Ex.) , Application of computer techniques in mechanics (L., Ex.)
Computer Science	I (Eng.)	Numerical methods (L., Lab.)
General (dedicated for ERASMUS+ Students)	I (Eng.)	Dynamics of machines (Lab.), Fundamentals of robotics (Lab.), Numerical methods for engineers (Lab.), Simulations of dynamical systems (Lab.)

6.1.3. Supervising student internships

Together with K. Augustynek, PhD., I am the organizer and supervisor of summer internships (June 15-September 15) for Erasmus+ students (2017-22 students, 2018-12 students, 2019-12 students, 2020-5 students, 2022-10 students). An example schedule of internships can be seen at: https://wbmii.ath.bielsko.pl/erasmus/erasmus-internship-offer-4.html

6.1.4. Promotion of Eng. and MSc. theses

➢ MSc. theses

- Design of a virtual station for testing gyroscopic phenomena of a selected rotor machine (Mechanical Engineering, 2017)

➢ Eng. theses

- Design of a two-level roller feeder supporting the assembly process (Mechanical Engineering, 2023)
- Modelling the dynamics of a gantry crane used to BOP transport (Mechanical Engineering, 2021)
- Application of the recursive Newton-Euler algorithm to formulate a model of the dynamics of a selected industrial robot (Automation and Robotics, 2021)

- FANUC LR MATE 200iD robot dynamics model with application the recursive Newton-Euler algorithm (Automation and Robotics, 2021)
- Dynamics analysis of the crane with taking into account the flexibility of the supporting system (Mechanical Engineering, 2018)
- Application of the recursive Newton-Euler algorithm in modeling the dynamics of the FANUC LR Mate 200iD robot (Automation and Robotics, 2016)
- RC vehicle with radio-controlled electric-diesel drive (Mechatronics, 2016)
- Modelling the dynamics of manipulators on the example of the Scara manipulator (Automation and Robotics, 2015)
- Modelling the dynamics of the FANUC LR Mate 100i robot (Automation and Robotics, 2015)
- Modelling the dynamics of the FANUC LR Mate 200i robot (Automation and Robotics, 2015)
- Application of the Newton-Euler equations iterative algorithm in modelling the dynamics of the Kawasaki FS20C robot (Automation and Robotics, 2015)
- Dynamics analysis of the Comau SMART-3 S manipulator (Automation and Robotics, 2015)
- Dynamics analysis of the IRB 4600 robot (Automation and Robotics, 2015)
- Modelling the dynamics of the Kawasaki FS010E robot using the recursive Newton-Euler algorithm (Automation and Robotics, 2015)
- Design of a virtual workstation for Fanuc robots (Automation and Robotics, 2015)
- Analysis of robot dynamics on the example of a three-link robot - part 1. Algorithm for deriving equations of motion based on the Newton-Euler equations (Mechatronics, 2014)
- Analysis of robot dynamics on the example of a three-link robot - part 2. Algorithm for deriving equations of motion based on the Lagrange equations (Mechatronics, 2014)

6.1.5. Reviews of Eng. and MSc. theses

I prepared 32 reviews of Eng. theses in the field of Mechatronics (2015-8 theses, 2016-5 theses, 2017-7 theses, 2020-8 theses, 2021-5 theses).

6.2. Organizational activity

6.2.1. Functional positions

- Faculty Coordinator of the Erasmus+ program (2016-still)

6.2.2. Involvement in administrative and organizational work

- Member of the accreditation team for the field of Mechanical Engineering, UBB (2005),
- Member of the team for launching the Transport at the Faculty of Management and Computer Science (currently the Faculty of Management and Transport), UBB, (2009-2010),
- Member of the team for launching the specialization Design and 3D printing technologies in the field of Mechanical Engineering, Faculty of Mechanical Engineering and Computer Science, UBB, 2021,
- Member of the team for launching MSc. studies in the field of Mechatronics, Faculty of Architecture, Civil Engineering and Applied Arts, HTS Katowice, 2021.

6.2.3. Membership and functions performed and positions held in societies and organizations

- Member of the Polish Society of Theoretical and Applied Mechanics, branch Bielsko-Biala (2010-present),
- Treasurer of the Polish Society of Theoretical and Applied Mechanics, branch Bielsko-Biala (2013-2015, 2017-2019, 2019-2021,2021-still),
- Member of the Polish Society of Computer Methods of Mechanics (2016-still)
- Deputy member of the Audit Committee - Main Board of the Polish Society of Theoretical and Applied Mechanics (2015-2017).

6.2.4. Membership in councils and committees

- Member of the Council of the Faculty of Mechanical Engineering and Computer Science, UBB (2016-2019),
- Member of the Council of the Discipline of Mechanical Engineering, FMECS, UBB (2019-still),
- Member of the Commission for the Verification of Publication Achievements and Scores of the Council of the Discipline of Mechanical Engineering, FMECS, UBB (2020-still),
- Member of the Faculty Education Quality Assessment Committee, FMECS, UBB (2012-2016),

- Member of the Faculty Commission for the National Qualifications Framework, FMECS, UBB (2012–2016).

6.2.5. Organization of national and international conferences

- Secretary of the Scientific and Didactic Conference on Theory of Machines and Mechanisms, Bielsko-Biala–Szczyrk, (2008),
- Co-organizer of the "Mechatronics and Control" session of the International Design Engineering Technical Conferences & Computers and Information in Engineering Conference (IDETC/CIE 2017) - 13th International Conference on Multibody Systems, Nonlinear Dynamics, and Control (MSNDC) - August 6-9, 2017, Cleveland, Ohio, USA.

6.3. Academic mobility

- Delivering a series of lectures as part of the mobility of academic teachers: 17.02-21.02.2020 Metropolitan University of Tirana, Albania, Erasmus+ Teaching Mobility..

7. Apart from information set out in 1-6 above, the applicant may include other information about his/her professional career, which he/she deems important.

7.1. Awards, distinctions

- Distinction for active participation in work for the Faculty of Mechanical Engineering and Computer Science of the UBB in the years 2005-2008,
- Award of the Fiat Powertrain Technologies Poland concern for the doctoral thesis entitled "Dynamic analysis and control of flexible supported machines" (2011),
- 2 Rector's Awards for outstanding organizational activity (2007, 2008),
- 6 Rector's Awards for outstanding scientific activity (2009, 2015, 2016, 2017, 2018, 2019),
- Rector's Award for outstanding attitude in professional work (2022).

7.2. Cooperation with the socio-economic environment

In 2020, on behalf of SVEP Polska Piotr Marek based in Bielsko-Biala, the author together with K. Augustynek developed software for static analysis of telescopic masts - MastStabilityAnalyzer (Fig. 22).

The software enables the analysis of forces and stresses acting in individual parts of the mast for given static loads resulting from the wind pressure on the mast and the head located at the top of the mast, and from the action of gravity forces of individual elements of the structure.

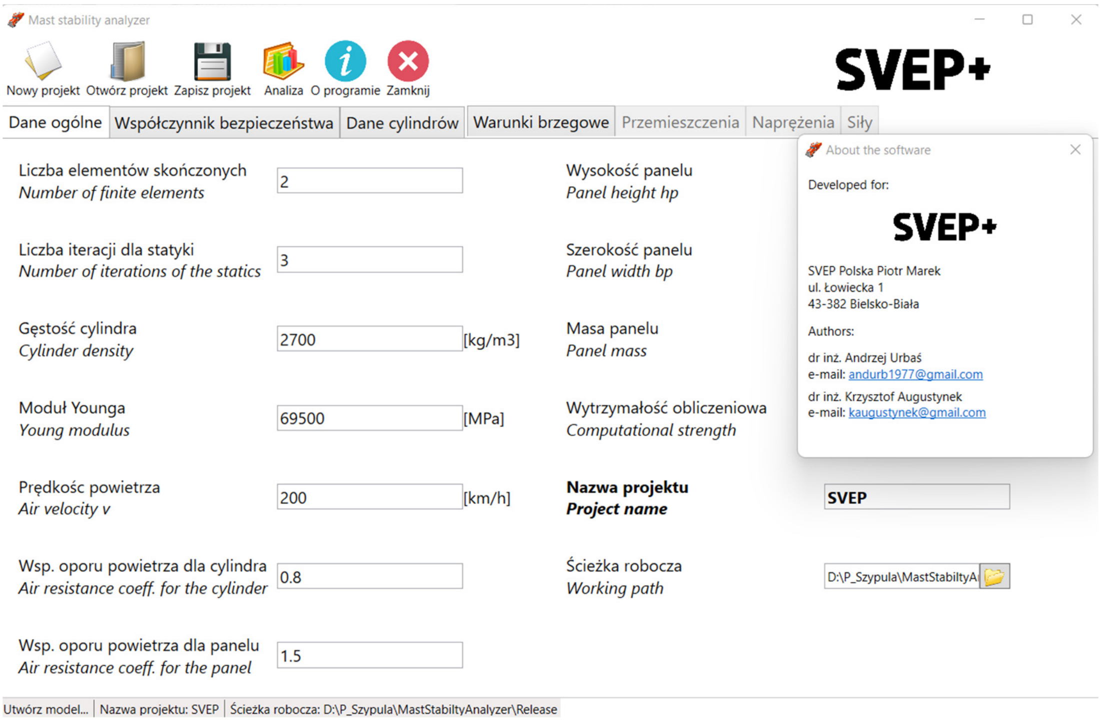

Fig. 22. Interface of MastStabilityAnalyzer program

7.3. Reviewing activity for prestigious, recognized, national or international publishing houses

I have prepared reviews of scientific papers for the following scientific journals:

- Applied Mathematical Modeling,
- Nonlinear Dynamics,
- Mechanism and Machine Theory,
- Latin Journal of Solids and Structures,
- Canadian Journal of Civil Engineering,
- ASME Journal of Dynamic Systems, Measurement, and Control,
- International Journal of Nonlinear Sciences and Numerical Simulation,
- Mathematical Problems in Engineering,
- International Journal of Structural Stability and Dynamics,
- Journal of Vibration Testing and Systems Dynamics,
- Advances in Materials Science,

- International Journal of Control,
- Mechanics Based Design of Structures and Machines,
- Springer Proceedings in Mathematics and Statistics,
- MDPI (Energies, Sensors, Machines, Actuators, Mathematics, Sustainability)
- etc.