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A SPECIAL ISSUE IN HONOR OF PROF. VALENTIN L. POPOV

FOREWORD

Valentin Leonidovich Popov is one the leading figures and visionaries in today's tribology research. It is with great pleasure and honor that we present to the reader this special issue dedicated to his 60th anniversary.

To understand mechanics nature, who gives so many useful lectures?
Who finds the time for all of us, for colleagues, family and science?
Who shows in Friction super class, and wear essence recognizes?
He governs friendly like the King - the only POPOV VALENTIN!
– Ruslan Balokhonov –

Herr Popov hat als mein Nachfolger in Berlin den von mir begonnenen Aufbau der Reibungsphysik sehr erfolgreich weitergeführt und weltweit sichtbar gemacht. Ich schätze unseren wissenschaftlichen Austausch sehr und freue mich auf viele Treffen, Diskussionen und gemeinsame Projekte in der Zukunft. Herzlichen Glückwunsch zum Geburtstag!
– Georg-Peter Ostermeyer –

Valentin is a person of many accomplishments. Being brilliant scientist, well-educated and intellectual, he seems to be deeply engrossed in his research - tribology, friction, adhesion and the like. On the other hand, we are happy to know him as a man who is ready to help, as a guy with a keen sense of humor, as a true friend…
– Varvara Romanova –

Für Sie stehen Forschung und Lehre stets im Vordergrund.
*Alles Gute zum 60. ! Die Kolleg*innen aus dem IfM*
– Utz von Wagner –

Russian Tribology community sends congratulations and the best wishes to Your 60th birthday! We appriciate your input in organization of scientific collaboration and German-Russian conferences and your activities in educating young scientists in mechanics and tribology.
– Irina Goryacheva –

Please accept my cordial greetings with this great day! I strongly wish you to conserve your young interest to the learning for the decades to come as well as your wonderful ability to see the things which are not visible for others.
– Sasha Filippov –

As Albert Einstein said, "If at first, the idea is not absurd, there is no hope for it." All contributing to this special issue were lucky to witness the unfolding of the MDR from Prof. Popov's bold idea (of mapping three-dimensional contact problems into one dimension) into a quick and reliable guide to Hertzian contact mechanics. And perhaps most admirable in this story is the courage and hope that Prof. Valentin L. Popov has shown to pursue his own idea in spite of the critique it has received from fellow scholars.

– Ivan Argatov –

Valentin's research publications are notable for the breadth of subject matter and for the physical and mathematical insight that he brings to every new problem. Also, his excellent books on subjects related to Contact Mechanics are a great resource both for experts in the field and for researchers and engineers whose primary focus lies elsewhere. I wish him the very best for his 60th birthday.

– Jim Barber –

I would like to say that I know Prof. Popov as a person who combines many unique qualities. He is able to explain in simple language many complex things, which is very important for a scientist, and even more so for a lecturer. I am grateful to him for the fact that with his direct participation, I decided on the choice of my scientific direction, and the solution of tribological problems by numerical methods at various scales became for me the main topic of my research.

– Andrey Dmitriev –

Your contribution to the development of tribology and contact mechanics is very impressive, but much of this science is not yet known and undiscovered. I wish you Siberian health, which will help you to make new discoveries in the physics of friction and will allow you to bring up new outstanding students!

– Viktor Kuznetsov –

Жизнь измеряется не годами, а трудами. Русская пословица

– Wolfgang Müller–

Even if prejudice is harder than atoms, I believe that one day, the heat of our continuous passion will melt it.

– Ken Nakano –

'Felix qui potuit rerum cognoscere causas' (Vergil)
That is, I believe, the impetus driving your research. As a scientist and university professor you have created something lasting and unique. I also thank you in particular for the good long-term cooperation and mutual support. With the most cordially wishes for your 60th birthday.

– Manfred Zehn –

Per aspera ad astra. A big thank you to Professor Popov for his immense contribution to the scientific journal Facta Universitatis Series Mechanical Engineering.

– Dragan Marinkovic –

I can say that I admire of Prof. Popov two things: one is the ability to go to the essentials of (tribological) problems, reaching solutions of engineering interest with the cleanest and simplest formulation, not using redundant mathematics to impress the reader (this having also a positive effect in teaching and in educating students at all levels). And the other is to have built a group of collaborators who apparently simply adore him, and this shows he is able to obtain from them the maximum collaboration also without redundant pressure.

– Michele Ciavarella –

We fully agree with Michele Ciavarella's last statement. Indeed, Valentin Popov has always been and continues to be successful in tying international bonds due to his supportive and generous character. We have reached out to a number of his close collaborators who have in turn contributed to this special edition. Their submissions present new advances in the topic of past and current research interests related to him, like wear or the interplay of frictional processes and the behavior of the system.

Johannes Otto and Georg-Peter Ostermeyer employed highly specialized tribotesters to investigate ultrasonic vibrations of brakes that are caused by the boundary layer. While they find a variety of influencing factors, the testing machine used is not one of them.

Ken Nakano and his colleagues investigated a system where the system dynamics indeed play a central role. They examined the stability of a 2DOF sliding system by an eigenvalue analysis, considering both the in-plane anisotropy and the in-plane asymmetry. The obtained eigenvalues were organized by using the minimum modal damping ratio as the stability maps, which can be used to reduce the effort for improving frictional properties.

Colleagues from the chair of Utz von Wagner present an experimental and theoretical study of a bistable beam equipped with magnets. They show that a discretization of such system should not be based on a single shape function.

Even in static configuration, mechanical system can interact with frictional contacts in non-trivial ways. Sangkyu Kim, Yong Hoon Jang and James Barber study two-dimensional systems with frictional contact concerning their ability to remain stuck in a wedged state. For every such system, a minimal coefficient of friction can be identified, below which wedging is impossible.

Irina Goryacheva and Elena Torskaya contribute an analysis of periodic contacts consisting of spherical indenters and a two-layered counterbody. They show how the geometrical and material parameters in such system influence stresses inside the bulk and on the surface.

Viktor Kuznetsov, Andrey Skorobogatov and Vladimir Gorgots submitted an in-depth experimental study on nanostructure burnishing. They describe how shear strain depends on burnishing parameters.

Ruslan Balokhonov and Varvara Romanova investigated a coated steel body under tension. They identify three distinct stages of plastic strain localization.

A major contribution of Valentin Popov is the development of the Method of Dimensionality Reduction which has emerged to a very convenient tool for dealing with a wide class of elastic contact problems. One very active collaborator in this field, Ivan Argatov traces back the origins of the method and demonstrates why the one-dimensional Popov foundation is much more powerful for mapping three-dimensional half-space contacts than the original two-dimensional Winkler foundation.

Michele Ciavarella and Antonio Papangelo contribute a paper dealing with the multiplicative coefficient for predicting friction in rough contacts due to bulk viscoelastic losses. They refer to an equation given by Popov in his textbook and find that the friction coefficient at low speed depends in general on the form of the viscoelastic modulus, while at high speed it mainly depends on the amplitude of roughness.

Andrey Dmitriev and colleagues submitted a paper on a topic that has recently been of high interest to Popov's lab; the formation of wear particles. They used conventional molecular dynamics to study the transition from sliding to abrasive wear. They find the original Rabinovicz' criterion to be accurate also for atomic objects!

Alexander Filippov and Stanislav Gorb considered biological systems and the way they evolute due to an underlying potential. They review ways to generate these potentials such that they account for observable phenomena.

The numerical solution of mechanical boundary-value problems with an explicit account for the material microstructure usually requires substantial computational resources. Varvara Romanova and her colleagues present an explicit dynamic approach that can be successfully used in microstructure-based simulations of quasistatic deformation, considerably reducing the computational costs without losing the information and solution accuracy.

In addition to taking into account the aspect of the internal rotational degrees of freedom of a material, micropolar media allow modeling materials with an internal structure. In their study, Wolfgang Müller and his colleagues lay the foundation for solving a fully coupled flow problem for a micropolar medium undergoing structural change in a funnel-shaped crusher.

Colleagues from the chair of Manfred Zehn implemented a new 3-node-shell element in Abaqus to model so called active structures. These consist of a combination of passive structures and active elements, for instance piezoelectric sensors and actuators. Their potential applications include the suppression of noise and vibration.

We welcome the many positive responses to our call for submissions from close colleagues of Valentin L. Popov. The breadth of submission mirrors his past and current research activity which has touched many topics not only within narrower tribology but also at the level of technical and biological systems as a whole.

On behalf of the entire lab "Systemdynamik und Reibungsphysik"

The Editors

Markus Heß, Roman Pohrt, Jasminka Starcevic