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Quantum contact mechanics for holistic material optimization

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Optimization tools for improved material development (e.g. protective coatings) do not only require a comprehensive mechanical contact model but also need to account for the principle uncertainties residing in the field. It will been shown that the classical continuum mechanical and thus, naturally deterministic, concepts are not adequate if one intends to holistically describe the uncertainties coming into play with applications connected with tribological processes like erosion, fretting, wear etc. This also and especially holds in the case of bio-applications as the living systems provide a kind of natural, omnipresent and very dominant uncertainty. By incorporating quantum mechanical concepts via a principle scale dependent accessibility with respect to input parameters from measurement, surface roughness or even non-continuous composition, one does not only overcome such flaws in the classical approaches but also automatically incorporates a method to observe and actively control the influence of the uncertainty budget. According to the classical quantum mechanics, the uncertainty is been accounted for by a "Planck" constant, only that this time, depending on the dimension of the problem, we end up with Planck-vectors or tensors instead of the classical scalar. The way to go is cumbersome at the beginning, because it requires the principle quantization of the line element of a general continuous space, but the outcome is a very compact, rather general and powerful tool to handle practical applications. As a byproduct, the quantization of the Einstein field equations can be achieved.

Biography

Norbert Schwarzer completed his Graduation in Physics at University of Chemnitz in 1991. After completing several research projects abroad and PhD in the field of Contact Mechanics in 1998, he became an Assistant Professor at University of Chemnitz in 1999. In 2005, he founded the Saxonian Institute of Surface Mechanics in Eilenburg/Germany. He published a variety of papers mainly in the fields of basic research and application of contact mechanical approaches for laminates, composites and layered materials.

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