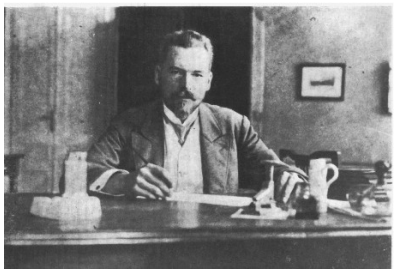

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Finite element modelling of atomic force indentation of an animal cell

Thursday, December 3, 2020 6:18 PM (1 minute)

We present a model of atomic force microscope indentation measurements using the finite element method. The focus is set on a thorough representation of the complex structure of an animal cell. Crucial constituent is the cell cortex — a stiff layer of cytoplasmic proteins present on the inner side of the cell membrane. It plays a vital role in the mechanical interactions between cells. In our model, the cell cortex is modelled by a three-dimensional solid characterized primarily by its bending stiffness. This approach allows us to interpret the measurements of the mechanical properties of the cells, such as elasticity. During the simulations, we probe a broad range of parameters defining cell properties and experimental conditions. Finally, we derive a simple and closed-form formula that approximates the simulated results with satisfactory accuracy. Our formula is as easy to use as Hertz's function in order to extract cell properties from the measurement, with additional consideration of the cell inner structure.

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