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Determination of effective mechanical properties of a double-layer beam by means of a nano-electromechanical transducer HANS HUEBL, FREDRIK HOCKE, MATTHIAS PERNPEINTNER, Walther-Meissner-Institut, Garching, Germany, XIAOQING ZHOU, École Polytechnique Fédérale de Lausanne, Lausanne, Switzerland, ALBERT SCHLIESSER, Niels Bohr Institute, Copenhagen, Denmark, TOBIAS J. KIPPENBERG, École Polytechnique Fédérale de Lausanne, Lausanne, Switzerland, RUDOLF GROSS, Walther-Meissner-Institut, Garching, Germany — In the field of optomechanics, the light field in an optical resonator dynamically interacts with a mechanical degree of freedom, enabling cooling and amplification of mechanical motion. This concept of light matter interaction can be transferred to the microwave (MW) regime combining superconducting MW circuits with nanometer-sized mechanical beams, establishing the class of circuit nano-electromechanics. To taylor the mechanical properties of a vibrational element, double and multi-layer systems are of particular interest, e.g. the combination of highly tensile stressed SiN and metallic layers allow to increase the mechanical resonance frequency while maintaining a capacitive coupling scheme. Here, we investigate the mechanical properties of a doubly-clamped, double-layer nanobeam embedded into an electromechanical system. The nanobeam consists of a highly pre-stressed silicon nitride and a superconducting niobium layer. By measuring the mechanical displacement spectral density both in the linear and the nonlinear Duffing regime, we determine the pre-stress and the effective Young's modulus of the nanobeam corroborating the analytical double-layer model expectations.

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