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Simulation of Silicon Microstructures

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The ever-growing trend toward using silicon as a mechanical material in solid-state sensors and actuators requires better understanding of the functioning and behaviour of microstructures. Simulation of the mechanical behaviour of microstructures such as diaphragms, microbridges and cantilever beams is necessary in order to optimize their performance. To that end, a simulation package—MICSTRUC—based on an adaptive grid generator and a macrotriangle finite-element method has been developed. The deflection and stress simulation for micromechanical structures under various load conditions has been accomplished by utilizing this package. The simulation model as well as the boundary conditions is described. The numerical results of deflection and related stress for various cases are presented.

1. Introduction

The full potential of silicon as a mechanical material for solid-state sensors and actuators was recognized in the late 70's and early 80's.[1,2] Since then, silicon microstructures have been extensively employed for many different sensors and transducers.[3–6] The common characteristic of these applications is the creation of microstructures such as diaphragms, microbridges and cantilever beams whose controlled mechanical behaviour is used to accomplish the appropriate function. Consequently, a full understanding of the behaviour and performance of such structures is a prerequisite for the design of improved sensors. Of specific interest are the