Calculation of Dynamic Stiffness of Cantilever in Torsional Motion

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Measurement of lateral force brings extra information on the local properties of the sample surface, such as interatomic friction [1]. One of the ways to measure lateral force is to use Si cantilevers in torsional motion [2]. Its motion is schematically shown in Figure 1. However, the dynamic stiffness of the cantilever in torsional motion is still not clear, though it is essential to quantitatively obtain the lateral force.

To clarify this point, the cantilever is modelled as a continuous medium, and its torsional equation of motion was solved. The dynamic stiffness and the dynamic moment of inertia were derived so that the mechanical energy of the cantilever is the same as that of the effective model [3]. The result suggests that the dynamic stiffness is larger than the static stiffness, and the dynamic moment of inertia is smaller than that of the cantilever. In this presentation, we will discuss how the static stiffness of the cantilever is modified to the dynamic stiffness in torsional oscillation and compare it with the dynamic stiffness in other oscillation modes. Additionally, dynamic stiffness of cantilevers with tips will be discussed, as dynamic stiffness changes due to the tips.

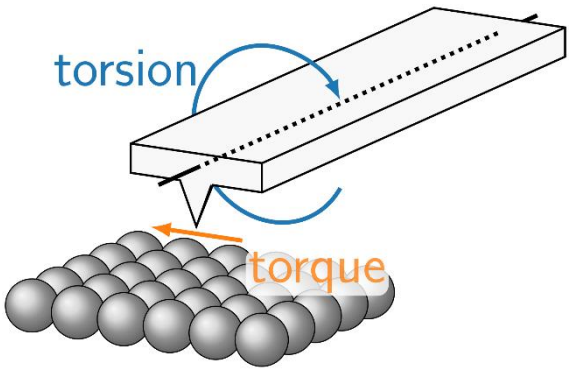

Figure 1. Schematic image of a Si cantilever oscillating in torsional motion while being subjected to a lateral torque above a sample surface.

Reference

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