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STRAIN ENERGY ON THE SURFACE OF AN ANISOTROPIC HALF-SPACE SUBSTRATE: EFFECT OF QUANTUM-DOT SHAPE AND POSITION

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Summary

Quantum-dot (QD) semiconductor device is one of the most actively investigated fields in current strain energy band engineering. As the induced strain fields need to be utilized in controlling and modulation of the energy bandgap within the associated semiconductors, analytical solutions to the QD-induced fields are very appealing and useful. In this paper we present an analytical method for calculating the QD-induced elastic field in the half-space semiconductor substrates. The QD is assumed to be of any polyhedral shape, and its surface is approximated efficiently in terms of a number of flat triangles. By virtue of the point-force Greena?Ts function solution, the induced fields due to each flat triangle of the QD are expressed in terms of a simple line integral over [0,i??] which is numerically integrated by the Gaussian quadrature. Numerical examples are presented for cubic, pyramidal, truncated pyramidal and point QDs in GaAs (001) and (111) half-space substrates. The strain energy distribution on the surface of the substrate indicates clearly the strong influence of the QD shape and position on the induced strain energy. This long-range strain energy on the surface has been found to be the main source for controlling and modulating the overgrown QD pattern and size.