Abstracts

Power Flow and Energy Storage in Piezoelectric Semiconductor Devices

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Traditionally the phenomenological constitutive relations for piezoelectric materials explicitly relate the electric displacement D/spl ovbr/ the electric intensity E/spl ovbr/, the stress tensor, and the strain tensor. This paper presents a new formulation for the theory of coupled wave interactions in a class of important hexagonal piezoelectric devices; here an equivalent dielectric description explicitly involving only D/spl ovbr/ and E/spl ovbr/ replaces (without approximation) the traditional formulation. The new formulation supplies the foundation for a new determination of power flow and energy storage on a basis broad enough to include the effects of diffusion and collisions on multivelocity multispecies carrier streams. The results, when specialized to a single-velocity single-species carrier stream, differ significantly with others recently proposed for those circumstances. The general results display a considerable degree of compactness and simplicity and are "electrically invariant" in that they hold for insulating, photoconducting, and semiconducting piezoelectric materials without any change in basic form.

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