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Thickness Effects on Piezoelectric Unimorphs under Various Boundary Conditions TAEWOO HA, NANSHU LU[1], Univ of Texas, Austin — Piezoelectric unimorphs are made of laminating a piezoelectric layer with an inert flexible substrate. We have developed a comprehensive understanding of the effects of unimorph thickness ratios on mechanical load induced voltages, charges, and energies, as well as voltage induced displacements of eight different boundary conditions, with both analytical and numerical means. By adopting an average σ_{33} stress method, the effect of d_{33} for both point and distributed loads is taken care of and our analytical equations are able to capture the FEM results which are obtained by COMSOL Piezoelectric Devices Module. Non-monotonic voltage and energy generation versus thickness ratio curves have been found for load-controlled energy generation scenarios. When the unimorph is actuated by voltage, non-uniform maximum deflection versus thickness ratio curves are also found. Our results reveal that the optimum thickness ratios for actuation are an order higher than the optimum thickness ratios for energy generation. In conclusion, closed-form analytical solutions are available for the thickness optimization of piezoelectric unimorphs depending on the application and boundary conditions.

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