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Treatment of the asymptotic behaviour of the piezolectric Green's function for finite element/boundary element analysis of surface waveguides

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The simulation of surface waveguides has been dramatically improved by the combination of analytic description of piezoelectric materials using surface Green's function and numerical approaches sur as plane wave expansion, finite diffrence, finite element, etc. A lot of work has been dedicated to treat the singularities of such Green's function generally derived in the spectral domain. An interesting approach consists in using the Green's function which relates the surface stresses to the displacements which is particularly well-suited for mixed finite element/boundary element formulations. This Green's function does not exhibit any pole but presents an asymptotic behavior which tends to infinity along increasing wavenumber values, which prevents the computation of its Fourier transform. In this work, we show how this difficulty can be overcome and we propose a formulation in which the Green's function is factorized in order to change its asymptotic behaviour to a form allowing for Fourier transform computation for non periodic problems and an analytic treatment of its asymptotic behaviour for the simulation of periodic structures. Examples are provided to show the interest of the proposed approach in terms of computation delays and precision.