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Construction of symmetrical and asymmetrical notches from elementary steps in isotropic plates

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The interactions of the fundamental Lamb modes with discontinuities in an isotropic structure will be presented and analyzed in a simple and a fast way. The key point is to decompose the symmetrical or asymmetrical notch into two elementary steps. The fundamental anti-symmetrical and symmetrical Lamb modes contributions are separated by means of the simple arithmetic operations of addition and subtraction. The power reflection and transmission coefficients are then computed with the well-known average power flow equation described in a previous work [NDT&E international, Vol. 41, 2008, p.1-9]. Using these coefficients, the symmetrical notch can be constructed from one elementary symmetrical step while the asymmetrical notch is constructed from the superposition of asymmetrical down- and up- steps. Mode conversions phenomena are observed and analyzed for the asymmetrical steps and notches case. Finally, an experimental device is realized to test aluminum plates with different notch depths. Good agreement is found between experimental and numerical results.