Localized waves at viscoelastic interfaces between viscoelastic media

*J. Kappler, R. Netz

Freie Universität Berlin, Berlin, Germany

Everyone has seen surface water waves, whose properties depend on gravity and surface tension [Tho71]. If there is a surfactant on water so that the surface behaves (visco)elastically under lateral compression, like e.g. in the case of a biomembrane on water, also another type of surface waves called longitudinal capillary waves can exist [Luc68]. On the other hand, on a viscoelastic half-space there exist Rayleigh waves [Cur77]. These are surface waves which, in the large scale, can be excited by earthquakes [Hua03], or, in the small scale, can be excited on materials to measure their mechanical properties non-destructively [Hvi98].
We present a unified treatment of all of the above waves: We consider two viscoelastic half-spaces separated by a viscoelastic interface and derive a general equation, whose solutions are dispersion relations for localized waves at the interface. We then show how all of the aforementioned waves can be derived from this general equation and present some results on how they are interrelated.
Since soft matter can often be modelled as viscoelastic, and interfaces in biology usually have viscoelastic properties themselves [Gab11], our formalism can be used to determine mechanical properties of biological and other soft materials non-destructively and potentially might also be of relevance to processes occurring in vivo [Gri12].

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