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Discussions and Replies — Session X

Multiple Authors

DISCUSSIONS AND REPLIES
SESSION X

Discussion on paper titled: "**Dynamic Modelling of Layered Systems to Moving Surface Loads: Applications**", by R.Siddharthan, G.M.Norris and M.El-Gamal, Paper No. 10.02.

By: Jiří Náprstek, Institute of Theoretical and Applied Mechanics, Prague, Czech Republic.

Dynamic behaviour of a linear stratified layer of porous partly saturated material under moving vertical load has been studied. Results of experimental work are extraordinary and I am looking forward to next studies the authors are certainly preparing.

They have published earlier several papers describing the basic theory. For this reason there is a bit difficult to obtain a full overwiev about the whole philosophy of their theoretical solution. Newertheless I would like to do some comments to particular steps they have used in their theoretical work.

There is a lot of papers and monographs dealing with a moving load influences on continua under various conditions, see e.g. Frýba, Filippov, and many others. Horizontally infinite systems, e.g. rails on elastic support are usually solved using Fourier transform which makes possible to do very deep qualitative analysis of basic properties of waves propagating in subsoil. First of all the critical speed c_{krit} of loading motion should be find out. The speed level of $100ms^{(-1)}$ is high enough to bring a high difference between waves character "before" and "after" loading despite an effective damping due to hydraulic or viscous properties of the continuum. Many types of entirely different waves can be observed acting in that system as a function of loading speed (subcritical, transsonic, supercritical, various combinations of contact waves in sub and supercrical versions, various types of Love's waves in contact of layer, multiple reflections diminishing effective wave influence, etc.).

Internal viscosity beeing modeled using complex shear modulus eliminates implicitly any dependence of damping on frequency and could lead to non-unique solution (Babuška, Koloušek). For these reasons Voigt, Kelvin and rational derivative models are frequently used.

I think a usage of any linearisation in wave propagation problems should be strictly limited to very small hardening or softening non-dropping nonlinearities. Otherwise typical non-linear wave effects could be unintentionally suppressed (cnoidal waves, solitary waves, bores, etc.).

Discussion on paper titled: "**Elastic Wave Propagation in Inhomogeneous Media due to Surface Shock Loading**", by D.S.Shridhar and V.S.Chandrasekaran, Paper No. 10.09.

By: Jiří Náprstek, Institute of Theoretical and Applied Mechanics, Prague, Czech Republic.

Instationary waves propagation in a 3D axially symetric cylindrical continuum with variable properties has been analysed. External excitation has been taken into account in a form of the Heaviside function in time acting over a circular area. The solution strategy has been based on the theory of circular finite elements of quadrilateral cross section, e.g. Zienkiewics, Taylor, etc.

The Authors decided to solve the problem of waves reflection using extrapolation algorithm in a proximity of transmiting boundaries. There is a lot of papers dealing with this problem adopting various correction coefficients in extrapolations or testing various degrees of interpolation. Behaviour of this boundary type can be questionable if the excitation would be more complicated in space and especially in time.

Numerical results presented by authors seem to be realistic in both horizontal as well as vertical coordinates. However there exist analytical solutions for harmonic excitation and exponential and other types of vertical changes of material properties (see e.g.C.Vrettos, 1994, Vienna 10th ECEE and other authors). An appropriate comparison would be interesting.

The paper has been written understandibly and I would llike to congratulate authors to their work.

Discussion on paper titled: "**R-Wave Dispersion Analysis in Transversely Isotropic Stratum.**", by Shiming Wu and Lizhong Wang, Paper No. 10.13.

By: Jiří Náprstek, Institute of Theoretical and Applied Mechanics, Prague, Czech Republic.

Authors have presented two methods applicable to study Rayleigh wave in transversally isotropic or layered continuum: Finite layer analysis and semi-infinite layer analysis. In following explanation the second one has been described in a more detailed form.

Excelent results have been obtained analysing a sensitivity to anisotropy ratio. Newertheless I would like to present some personal opinions or, could be, some ideas for further research.

The classical derivation of superficial and contact waves separates a displacements field into two parts:

$$\mathbf{u} = \mathbf{u_1} + \mathbf{u_2} \; ; \; rot\mathbf{u_1} = 0 \; ; \; div\mathbf{u_2} = 0$$

which leads to more logical form of the solution.

I did not understand the eq.(14). Rayleigh wave has been derived for homogeneous boundary conditions (for this reason an eigenvalue problem). If any harmonic stress variable in x coordinate is acting on a boundary then other type of wave shlould be introduced in an initial guess of the solution.

An equation for wave number should have at least one real negative solution, whereas other solutions must be neglected leading to solutions which are contradictory with Raylegh wave type (periodic solution in vertical direction, etc.). The equation (17) very probably has got only complex roots (quadratic eigenvalue problem).

An asymptotic study wuld be very usefull due to fact, that every superficial waves are decreasing very rapidly in the vertical direction to the boundary. They practically vanish in a distance one wave period from the boundary.