
Modeling of the interaction of a shock wave and a cylindrical shell

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In the work we offer a method of calculating the pressure on the surface of the cylindrical shell in the period of immersion and flow of it by a shock wave. A comparative assessment of the exact solution and the existing approximate solutions is carried out for weak shock waves. We consider two types of waves on the surface of the rigid shell, incident and reflected. As a result we obtained a pattern of pressure distribution on the shell surface dependent on the said types of waves.

Keywords: incident shock wave, reflected shock wave, overpressure, cylindrical shell, integral transformation, the asymptotic representation.

REFERENCES

- [1] Karlov N.V., Kirichenko N.A. *Kolebaniya, volny, struktury* [Vibrations, waves, structures]. Moscow, Fizmatlit, 2011, 497 p.
- [2] Regirer L.S. *Shock waves*. Moscow, Nauka Publ., 1979, 542 p.
- [3] Aleshkov Yu.Z. *Teoriya vzaimodeystviya voln s pregradami* [The theory of the interaction of waves and obstacles]. Leningrad, LST Publ., 1990, 371 p.
- [4] Pikovsky A., Rozenblyum M., Kurts Yu. *Sinkhronizatsiya: Fundamentalnoe nelineynoe yavlenie* [Synchronization: The fundamental nonlinear phenomenon]. Moscow, Tekhnosfera Publ., 2003, 496 p.
- [5] Kubenko V.D. *Proniknovenie uprugikh obolochek v szhimaemuyu zhidkost* [Penetration of elastic shells in compressible fluid]. Kiev, Naukova dumka Publ., 1984, 158 p.
- [6] Dimitrienko Yu.I. *Mekhanika sploshnoy sredy. Tom 2. Universalnye zakony mekhaniki i elektrodinamiki sploshnoy sredy* [Continuum Mechanics. Vol. 2. Universal laws of mechanics and electrodynamics of continuous media]. Moscow, BMSTU Publ., 2011, 560 p.
- [7] Volmir A.S. *Obolochki v potoke zhidkosti i gaza. Zadacha aerouprugosti* [Shells in the flow of liquid and gas. Aeroelasticity problem]. Moscow, Nauka Publ., 1976, 416 p.
- [8] Moiseev N.N. *Asimptoticheskie metody nelineinoy mekhaniki* [Asymptotic methods of nonlinear mechanics]. Moscow, Nauka Publ., 1969, 379 p.
- [9] *Asimptoticheskie metody v mekhanike. Sbornik statey* [Asymptotic methods in mechanics. Collection of papers]. Novosibirsk, Publishing House of the Siberian Branch of the USSR Academy of Sciences, 1987, 380 p.
- [10] Mendlin R.P., Bleich H.H. Response of an elastic cylindrical shell to a transverse step wave. *J. Appl. Mech.*, 1953, vol. 20, no. 2.
- [11] Glin'skiy M.M., Lebedev M.G., Yakubov I.R. *Modelirovanie techeniy gaza s udarnymi volnami* [Modeling of gas flows with shock waves]. Moscow, Mashinostroenie Publ., 1984, 191 p.
- [12] Landa P.S. *Nelineinyye kolebaniya i volny* [Nonlinear vibrations and waves]. Moscow, Nauka Publ., 1997, 495 p.

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