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Steady compressible flow in collapsible tubes: Application to forced expiration. (English)

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Summary: Steady, one-dimensional flow of a compressible fluid through a collapsible tube is analysed. A general model is employed, incorporating axial variations in the parameters of the conducting system, such as the tube unstressed cross-section area and wall stiffness, the external pressure and energy exchange with the environment. The flow variables are described in differential form as functions of the conduit system parameters. A coupled set of equations for the dependent flow variables is summarized in a table of influence coefficients, which provides a clear and simple description of the effects produced by the system parameters. Examples of the effects of fluid compressibility in the respiratory system are presented for forced expiration manoeuvres. The effects are found to be generally small, but are most accentuated when breathing heavy gases and when the airways are pathologically stiffened.

MSC:

76N15 Gas dynamics, general

76M99 Basic methods in fluid mechanics

Cited in **3** Documents

Keywords:

steady, one-dimensional flow of a compressible fluid; collapsible tube; wall stiffness; external pressure; energy exchange; forced expiration

Full Text: [DOI](#)

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