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Technical Comments

Brief discussion of previous investigations in the aerospace sciences and technical comments on papers published in the AIAA Journal *are presented in this special department. Entries must be restricted to a maximum of 1000 words, or the equivalent of one* Journal *page including formulas and figures. A discussion will be published as quickly as possible after receipt of the manuscript. Neither the AIAA nor its editors are responsible for the opinions expressed by the correspondents. Authors will be invited to reply promptly.*

Comment on "Spacecraft Launch Depressurization Loads"

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A THEORETICAL model of the discharge process of a reservoir into a decreasing time-dependent pressure atmosphere has been recently published by Sanz-Andrés et al.[1] Numerical integration of the compressible equations has been used to obtain the range of asymptotic solution. However, the closed-form expressions for the subcritical isothermal and isentropic venting or charging gas from a single hole has been presented by Yang.[2] Later, a generalized expression[3] has been derived for subcritical isothermal and isentropic venting cases.

A closed-form expression for the incompressible, isothermal, and polytropic coefficient of unity for Eq. (12) of Ref. 1 can be written as

$$p_f/p_i = [(I^2+1)/2I]^2 \tag{1}$$

$$I = \left[\sqrt{(p_e/p_i)-1} + \sqrt{p_e/p_i}\right] \exp\left[-C_D(A/2V)\sqrt{RT_0}(t_f - t_i)\right]$$

where A is vent area, V is reservoir volume, C_D is discharge coefficient, T_0 is temperature inside the launch fairing, R is gas constant, p_e is ambient pressure, and p_f and p_i are final and initial pressure at time t_f and t_i, respectively.

References

[1] Sanz-Andrés, Á., Santiago-Prowald, J., and Ayuso-Barea, A., "Spacecraft Launch Depressurization Loads," *Journal of Spacecraft and Rockets*, Vol. 34, No. 6, 1997, pp. 805–810.

[2] Yang, H. T., "Formulas for Venting or Charging Gas from a Single Volume," *AIAA Journal*, Vol. 24, No. 10, 1986, pp. 1709–1711.

[3] Kato, H. T., "Comments on 'Formulas for Venting or Charging Gas from a Single Volume,'" *AIAA Journal*, Vol. 25, No. 9, 1987, pp. 1273, 1274.

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Reply to R. C. Mehta

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FIRST I would like to thank R. C. Mehta for paying attention to the paper of reference.

My replies to his comment are the following ones:

1) Concerning the first paragraph, both Eq. (1) in the Comment by Mehta and those in Refs. 1 and 2 are not applicable to the launch depressurization calculations because these formulas are based in a constant external pressure, whereas in the launch depressurization calculations the external pressure (the pressure under the fairing) is a time-dependent function. In fact, a closed-form solution for the inner pressure variation with time, when an arbitrary law of variation of fairing pressure is imposed, is given in dimensionless form by Eq. (19) of Ref. 3, which is valid in the low-pressure jump limit (so-called asymptotic solution).

2) Concerning the second paragraph, Eq. (12) of Ref. 3 is just a suitable definition of a characteristic time used for making the mathematical formulation nondimensional and, therefore, more compact; it is not "a closed form expression for incompressible, isothermal and polytropic coefficient of unity," and it is not a result that could be substituted by Eq. (1) of Mehta.

References

[1] Yang, H. T., "Formulas for Venting or Charging Gas from a Single Volume," *AIAA Journal*, Vol. 24, No. 10, 1986, pp. 1709–1711.

[2] Kato, H. T., "Comments on 'Formulas for Venting or Charging Gas from a Single Volume,'" *AIAA Journal*, Vol. 25, No. 9, 1987, pp. 1273, 1274.

[3] Sanz-Andrés, Á., Santiago-Prowald, J., and Ayuso-Barea, A., "Spacecraft Launch Depressurization Loads," *Journal of Spacecraft and Rockets*, Vol. 34, No. 6, 1997, pp. 805–810.

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