forth by Rao,[1] as applicable to a wider class of nonlinear systems, has been reported earlier by this author in his doctoral thesis[4] as well as in the open literature.[5] These studies not only give this generalized relationship but also put forth the concepts on which it is based and the rationale for obtaining such relationships.

Considering a general class of second-order, nonlinear systems in the form,

$$\ddot{x} + g(x)\dot{x}^2 + f(x)\dot{x} + F(x) = 0; \; f(x) \neq 0$$

(when $g(x) = 0$, i.e., without quadratic damping, this equation reduces to the case considered in Refs. 1 and 2), the sufficient condition for obtaining an equivalent linear system is that

$$F(x) = k_1 f(x) \left[\int_0^x f(\tau) \exp\left(\int_0^\tau g(\theta)\, d\theta\right) d\tau + k_2\right] \times \exp\left(-\int_0^x g(\theta)\, d\theta\right)$$

When $g(x) = 0$, this condition reduces to:

$$F(x) = k_1 f(x) \left(\int_0^x f(\theta)\, d\theta + k_2\right)$$

which essentially is the condition obtained by Rao.[1]

Regarding the two approaches suggested by Rao, although they prove to be interesting mathematical calisthenics, the example considered clearly shows that these approaches involve complexities in integration and algebra far more severe than those encountered in the earlier approach.[2–5] The transformation of inverting the role of dependent and independent variables used by Rao is quite well-known[6,7] and in fact has been in use to solve classes of Abel's nonlinear, first-order differential equations by converting them to linear, second-order equations, i.e., in the opposite direction. (In the partial differential equations domain, it has been known under the name of Hodograph transformations.[7])

For example, an Abel's equation of the type

$$\dot{x} = ax^2 + (bt + c)x^3$$

through a transformation of the type

$$x = \dot{y} = 1/dt/dy = 1/t'$$

can be converted to a linear second-order equation,

$$t'' + at' + bt + c = 0$$

However, in some cases these alternate approaches may prove to be useful and as such are welcome additions. The author wishes to take this opportunity to correct a mistake in Ref. 2 wherein Eq. (9) should read

$$\ddot{x} + ax\dot{x} + bx = 0$$

While this equation does correspond to an oscillatory system with nonlinear damping, it no longer represents surge tank oscillations.

References

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Errata: "A Transformation Theory for the Compressible Turbulent Boundary Layer with Mass Transfer"

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SEVERAL errors occur in Equations (15–17) of this paper. The correct forms should read as follows:

$$\tilde{u} = (\bar{c}_f/2\bar{F})[\exp(\bar{F}R_{\bar{y}}) - 1]; \; 0 \leq R_{\bar{y}} \leq R_{\bar{y}_s} \quad (15)$$

$$\ln(R_{\bar{\delta}}{}^2\bar{c}_f/2)^{1/2} = k_1\{(2/\bar{F})(\bar{c}_f/2)^{1/2} \times [(1 + 2\bar{F}/\bar{c}_f)^{1/2} - 1] - k_2 - 2\pi/k_1\} \quad (16)$$

$$R_{\bar{\theta}}/R_{\bar{\delta}} = (\bar{c}_f/2)^{1/2}(1 + 2\bar{F}/\bar{c}_f)^{1/2}(I_1 + 0.5\bar{F}I_3) - (\bar{c}_f/2)(1 + 2\bar{F}/\bar{c}_f)I_2 - 0.25\bar{F}(I_2 + 0.25\bar{F}I_4) \quad (17)$$

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