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A Novel *zT* Meter Based on the Porcupine Method and a Survey on the Size of the Snout Correction Needed for Various Thermoelectric Devices

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Measurements of the dimensionless figure of merit of different thermoelectric devices are presented and discussed, as obtained with a prototype *zT* meter which is based on the porcupine method. The instrument's architecture and operation are discussed to support claims made on the accuracy of results. Different types of thermoelectric devices were tested, focusing on the size of the porcupine's snout for each. The latter is probably the major source of uncertainty in Harman methods, but is well measurable with the porcupine method, which therefore allows definition of the correction needed to obtain accurate evaluation of *zT*. Accuracies much better than 1% in the determination of the dimensionless figure of merit and series resistance are possible in this way. A survey of various devices is reported, and results are shown to indicate that corrections up to the 10% level and more are needed, depending on the configuration.

Key words: Thermoelectricity, figure of merit, vector impedance meter, *zT* meter, porcupine diagram

Nomenclature

f	Frequency (Hz)
I_0	Electric current of the generator (A)
j	Imaginary unit
$K_{TE}/2$	Total DC thermal conductance of the thermoelectric elements (W K^{-1})
R	Series electric resistance of the module in DC (Ω)
R_B	Electrical resistance defined in Fig. 1 (Ω)
R_C	Electrical resistance of the center of the porcupine body's circle (Ω)
R_I	Instrument's reference resistance, $R_I = V_0/I_0$ (Ω)
R_x	Variable resistance in the optimization process of Eq. 4 (Ω)
R_ε	Equivalent resistance of the Seebeck effect (Ω)
T	Temperature (K)
V_0	Electric voltage of the generator (V)
V_Ω	Ohmic voltage drop (V)
y_T	Total complex thermal admittance (W K^{-1})
z_{el}	Complex electrical impedance (Ω)
zT	True dimensionless figure of merit of the module

Greek symbols

β, γ	Phase angles defined in Fig. 1
δ	Relative circularity error of the porcupine body discussed in Ref. 4
Δ	Quantity to be minimized in the optimization process of Eq. 4

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