A MATHEMATICAL FRAMEWORK FOR THE STUDY OF INDIRECT DAMPING MECHANISMS

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ABSTRACT

Indirect damping, as it applies to a linear oscillator $\dot{x} = Ax$, induces energy decay through coupling of this system with an auxiliary dissipative system, rather than through insertion of dissipative terms in the original equation. Familiar physical examples lead one to distinguish (at least) two types of indirect damping; the *velocity coupled dissipator* and the *displacement coupled dissipator*. While these induce energy decay through quite distinct physical processes, we are able to show that they are mathematically equivalent. We go on to develop the mathematical properties of these models and to explore sufficient conditions under which frequency proportional damping rates may be expected. A number of examples, taken from familiar physical contexts, are cited.

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