



May 8th, 9:30 AM - 4:30 PM

## Why do Textbooks Ignore the Coulombically Damped Oscillator?

Larbi Jon Murray  
*Illinois Wesleyan University*

Narendra K. Jaggi, Faculty Advisor  
*Illinois Wesleyan University*

Follow this and additional works at: <https://digitalcommons.iwu.edu/jwprc>

---

Murray, Larbi Jon and Jaggi, Faculty Advisor, Narendra K., "Why do Textbooks Ignore the Coulombically Damped Oscillator?" (1993). *John Wesley Powell Student Research Conference*. 19.

<https://digitalcommons.iwu.edu/jwprc/1993/posters/19>

This is protected by copyright and/or related rights. It has been brought to you by Digital Commons @ IWU with permission from the rights-holder(s). You are free to use this material in any way that is permitted by the copyright and related rights legislation that applies to your use. For other uses you need to obtain permission from the rights-holder(s) directly, unless additional rights are indicated by a Creative Commons license in the record and/ or on the work itself. This material has been accepted for inclusion by faculty at Illinois Wesleyan University. For more information, please contact [digitalcommons@iwu.edu](mailto:digitalcommons@iwu.edu).

©Copyright is owned by the author of this document.

## Why Do Textbooks Ignore the Coulombically Damped Oscillator?

Larbi Jon Murray, Physics Department, IWU, Narendra K. Jaggi\*

The damped simple harmonic oscillator is the quintessential example used to introduce physics students to dissipative dynamics. Texts currently in use at leading institutions follow this time honored pedagogical tradition and always discuss the case where the damping force is proportional to the velocity of the particle. The case of a damping force that is constant in magnitude (Coulombic friction being a garden variety example) is simply ignored. We found this problem to be simple and yet quite interesting. In particular, it is easy enough to be discussed in introductory physics courses.

The basic result is that the amplitude of the oscillator decreases linearly, as opposed to the ubiquitous exponential decay that every textbook dutifully displays for the case of velocity dependent damping. We also performed experiments using mass on a spring on an airtrack where the air pressure was reduced so that the glider was lightly rubbing against the track. Video recording of the low frequency oscillations followed by analysis of the images gave us the time dependence of the amplitude. The linearly decreasing amplitude was in excellent agreement with the prediction of our model. By controlling the pressure, we could adjust the ratio of Coulombic and velocity dependent damping. It was possible to cross over from the linear regime at one extreme to the exponential regime at the other extreme. We intend to share these results with authors of college physics texts.