

Mesosopic Modeling of Mechanical Radiometers

Statement of Purpose

My goal is to study radiometers, reflective turbines operating on radiative and convective forces. The project will culminate with the construction of a macroscopic radiometer to test certain unknown parameters.

Background

Light is one of the most omnipresent yet enigmatic objects of inquiry one can imagine. Radiometers were invented as a way to estimate the luminous output of unknown sources, and still offer many insights into unexplored areas of fluid dynamics. Depending on the conditions, they operate on either incident radiation pressure or convective forces, and vary greatly in regime and design.

Significance

I will examine radiometers both as inferential devices and potential sources of energy conversion. The end goal would be to procure a coating allowing it to function as a makeshift geiger counter.

Research Methodology

My methodology is twofold:

- I. Conducting research in silico for optimizing radiometer designs, under a variety of conditions and media;
- II. Testing these designs by conducting a number of radiometers of varying scales, fluid compositions and design.

My daily research will be conducted at the UA's PAS, under the guidance of Dr Manne. I have already been approved for \$100 of research funding, as well as use of pre existing equipment, with more funding under consideration if necessary.

My daily research would be at the UA PAS under the guidance of Dr Manne, where I have a starting budget of 100\$, as well as use of all the necessary facilities and tools.

Anticipated Problems

The project relies entirely on the production of very delicate systems with limited resources and fabrication capabilities, and as such the scope of this project may be forced to adapt.

Syllabus

Week 1: Preliminary tests (modifying prefab radiometers)

Week 2: Preliminary tests/Analytical System Dynamics w/Problems from Dr Manne

Week 3: Preliminary tests/Select Thermodynamic Models w/Problems from Dr Manne

Week 4: Continue prefab tests

Week 5: Construct Proof-of-Concept Radiometer

Week 6: Construct Proof-of-Concept Radiometer(cont.)/Testing

Week 7: Construct Final Radiometer

Week 8: Construct Final Radiometer

Week 9: Analysis

Week 10: Analysis/wrap-up

Literature

<http://math.ucr.edu/home/baez/physics/General/LightMill/light-mill.html>

https://www.princeton.edu/~achaney/tmve/wiki100k/docs/Crookes_radiometer.html

Fabien, Brian. Analytical System Dynamics: Modeling and Simulation, 1st Edition. 2nd Printing. 2008, XI, 326 p.

Reynolds, Osborne. "On the forces caused by the communication of heat between a surface and a gas; and on a new photometer." *Philosophical Transactions of the Royal Society of London* 166 (1876): 725-735.

Schuster, Arthur. "On the Nature of the Force Producing the Motion of a Body Exposed to Rays of Heat and Light." *Philosophical Transactions of the Royal Society of London* 166 (1876): 715-724.

