Solar Array Drive Assembly for LUMIO

Modeling and Simulation of Aerospace Systems

AY 2018-2019

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The **Lunar Meteoroid Impact Observer (LUMIO)** is a CubeSat mission to observe, quantify, and characterise the meteoroid impacts by detecting their flashes on the lunar far-side. LUMIO is one of the two **winners of ESA's LUCE** (Lunar CubeSat for Exploration) **SysNova competition**, and as such it is being considered by ESA for implementation in the near future.

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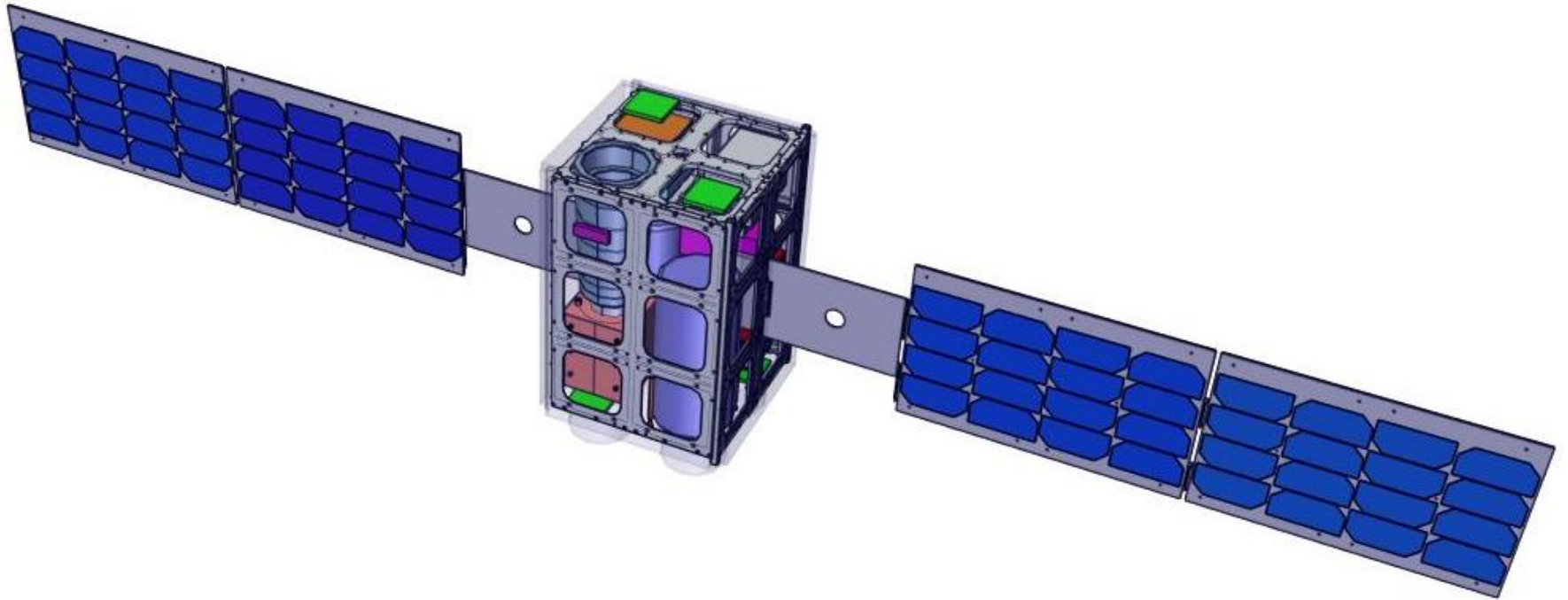
Electro-mechanical system
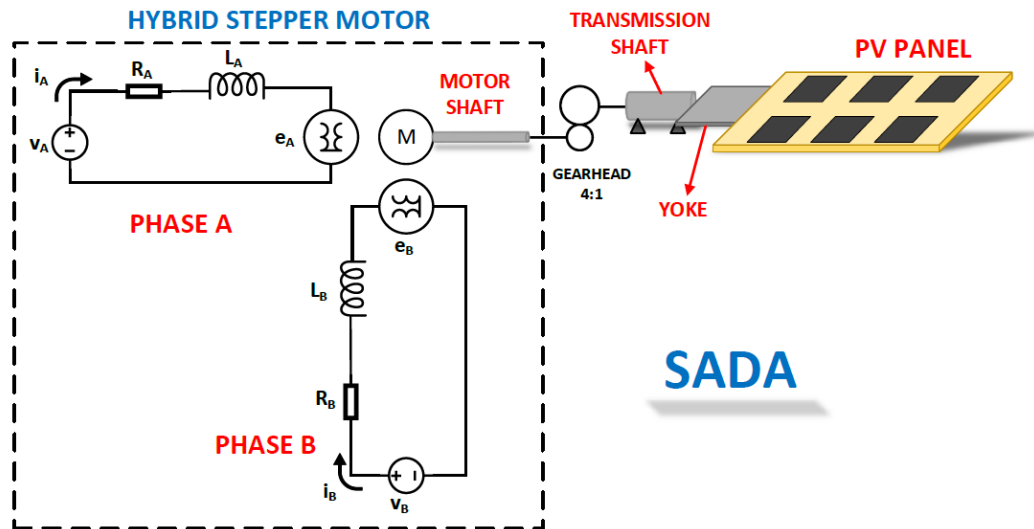
- KVL for each phase

$$v_i - R_i i_i - L_i \frac{\mathrm{d}i_i}{\mathrm{d}t} + e_i = 0$$

- Faraday's law:

$$e_i = -\frac{\mathrm{d}\phi_i}{\mathrm{d}t}$$

- Flux

$$\phi_A = \Phi\cos(p\theta)$$
$$\phi_B = \Phi\sin(p\theta)$$

Note that:

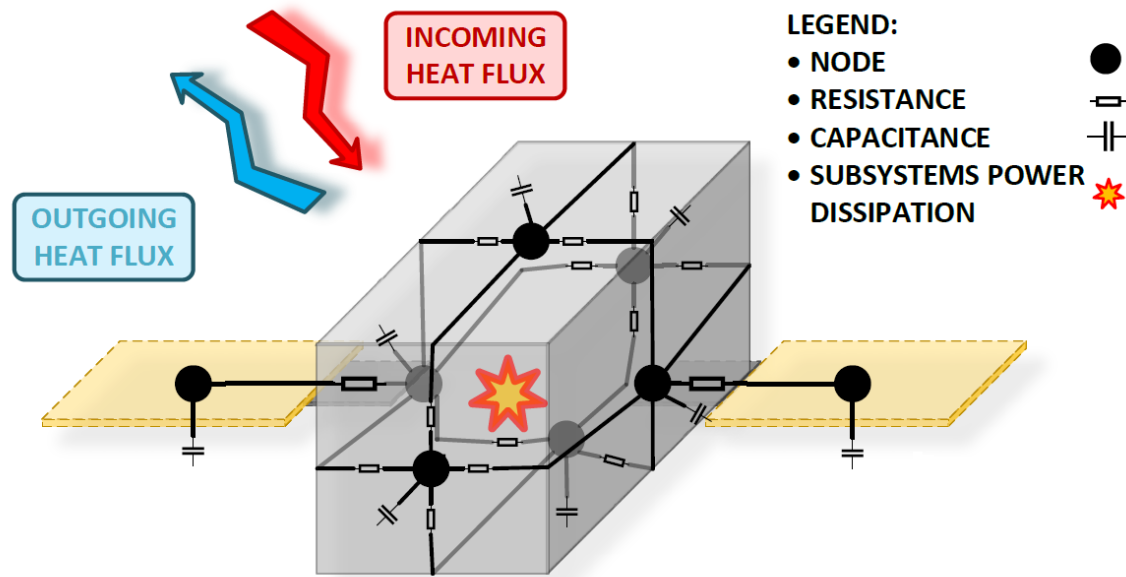- Total torque is given by the **sum of the torque** of each phase:

$$\tau = \tau_A + \tau_B$$

- There is a **reduction gear**:

$$\theta_{motor} = \frac{1}{r}\theta_{panel}$$

- Rotation **cannot be continuous** (It's a stepper motor!)
- **Solar panel** can be modeled as a **plate**

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Thermal system

LEGEND:
- NODE ●
- RESISTANCE
- CAPACITANCE
- SUBSYSTEMS POWER DISSIPATION ✦

- For each node

$$C_i \dot{T}_i = \sum_j \dot{Q}_j$$

Note that:

- You need to have at least **10 nodes**
- Thermal properties can be deducted from LUMIO data

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