



Lema

Linear Electro-Magnetic Actuator

Cubesat actuator

MECHANICAL PARAMETERS

- Core cross-section 8 [mm²]
- Core length 70 [mm]
- Coil overall diameter 10 [mm]
- Coil length 70 [mm]
- Coil cap on demand
- Core + coil weight 76 [g] each

ELECTRICAL PARAMETERS

- RDC (±2,5%) 6,8 [Ω]
- I_{MAX} 200 [mA]
- U_{MAX} 1,36 [V]
- Wire diameter 0,3 [mm]
- Connection solder pin / on demand

The coil resistance depends on Power System Unit specification and battery capacity.

MAGNETIC PARAMETERS

- H_c* <10 [A/m], or 12,5 [μT]
- B_s** 0,36 [T]
- Magnetic dipole moment D 0,39 [Am²]

Linearized actuator function:

$$B_c = B_E + (98,6 I \pm H_c) [\mu T]$$

or

$$B_E = B_c + (14,5 I \pm H_c) [\mu T]$$

Where B_c is the magnetic field intensity on the longitudinal coil axis in a 10 cm distance from the end face of the coil, B_E is external magnetic field in the same direction, I is the control current in A, U is the control voltage and H_c is the coil core coercivity.

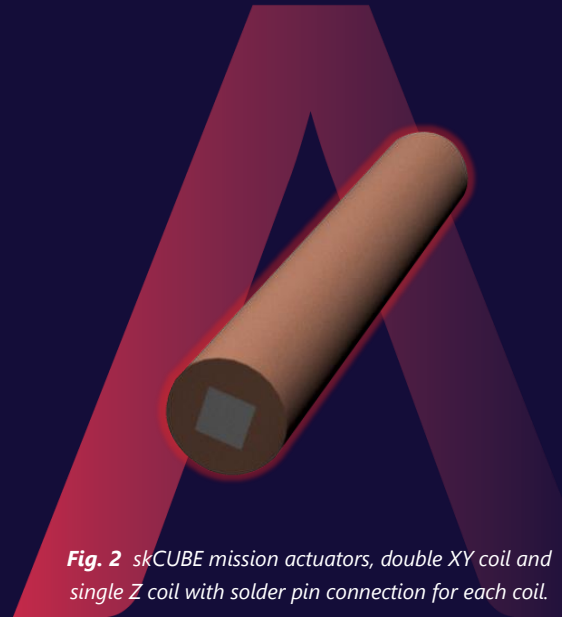


Fig. 2 skCUBE mission actuators, double XY coil and single Z coil with solder pin connection for each coil.

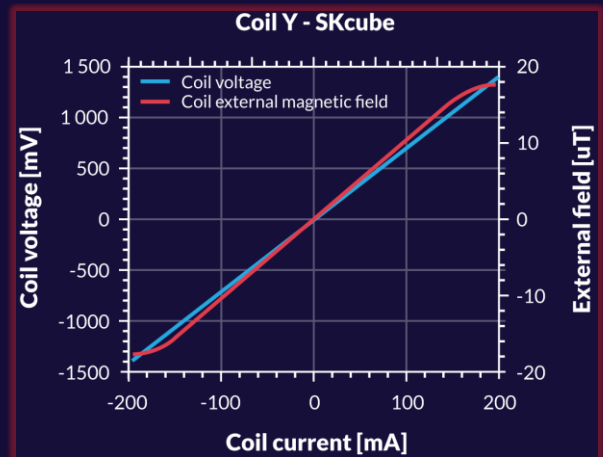


Fig. 1 Transfer curve measured in a 10 cm distance from the end face of the coil.

LEMA series actuators were developed for attitude control of the 1U CubeSat skCUBE. Actuators are designed for the smallest possible coercivity H_c . Cores of the coils are made from modern amorphous materials with almost zero H_c and linear magnetization curve. Mechanical parameters can be adjusted for the maximal possible length with respect to the frame capacity of the CubeSat (for example as they were custom-made for skCUBE – the first Slovak satellite). The coil maximum control current is 200mA. The transfer curve of the actuator is linear in this range, which gives the actuator maximum energy efficiency.

* depends on the core shape

** defined for the end core faces, computed at 200mA