System description

The system is composed by:

* A DC direct drive brushed motor
* Three carts
* Three springs
* A damper
* Several weights
* Three encoders for the position
* An encoder for the motor
* A PoliArd board

The mechanism consists of up to three mass carriages interconnected by bi-directional springs. The mass carriage suspension is an anti-friction ball bearing type with approximately ± 3 cm of available travel. The linear drive is comprised of a gear rack suspended on an anti-friction carriage and pinion coupled to the motor shaft. Optical encoders measure the mass carriage positions.

Three springs can be attached between the carts or between the first cart and the base plate. A damper can be implemented in various position and finally the mass of all the carts can be adjusted using the weights provided (500 ± 5 g each).

The encoder type is CP-850-4000-ECP: it is an optical incremental digital rotary shaft encoder. The number 4000 indicates the line counter (i.e the number of equally spaced radial lines per 360 mechanical degrees on the incremental encoder code disk). A low power light source is used to generate two 90 degrees out of phase sinusoidal signals on the detectors as the moving plate rotates with respect to the stationary plate. The moving plate rotates by means of an iron string wound up in it and then attached to the cart. The position is measured by calculating the angular displacement of the disk.

The motor encoder is used to transmit both voltage and current to the Arduino board.

The 24 Volt DC motor has a case diameter of 63 mm and 194 Watts of output power. It has a nominal speed of 3700 rpm and a nominal Torque of mN/m. The DC motor has nominally a resistance of 0.7 Ω and an inductance of 1.05 mH.

The poliArd board mounts an Arduino Due board. The board has a 24 V power supply and it’s capable of measuring up to 5 A current. It has two motor drivers and four encoder interfaces. The board is programmable and the control strategy can be implemented using Matlab 2015a.