



## EMOLVA-SC

Active way linear motor – Sensorless

### Project Summary

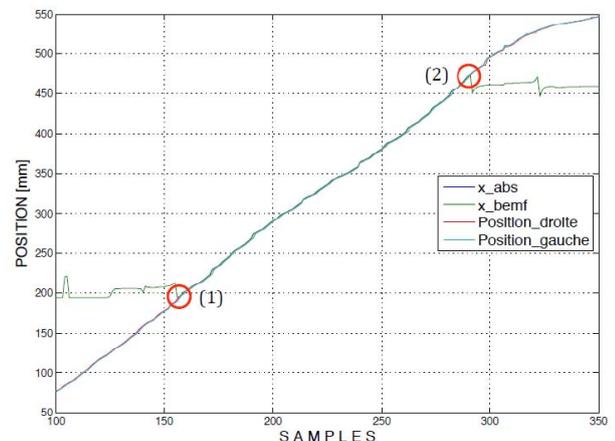
Today, the synchronous linear motors are widely used in industrial robotics. They typically consist of a glider carrying a three-phase winding and a magnetic path associated with a fixed mechanical guide and an optical or magnetic incremental position sensor. In the case of the active way linear motor, the concept is fully reversed: the fixed parts contain the coils and the magnets are associated with the glider. With a preceding project SageX 20063 eMoLVA (2009), financed by the competence network RCSO-TE, the system has been built and successfully tested making use of a position sensor (optical encoder).

The purpose of the new eMoLVA-SC project was to eliminate the position sensor and modify the existing electronics to perform this task. The figure above shows the prototype of the motor, and the power/control cards modified for the new project.

### Progress and results

To achieve the objective, three methods were investigated and tested:

- *Injection of a high frequency auxiliary signal.* The key idea is to use the variation of the coils current ripple due to the passage of the carriage at the PWM frequency.
- *Luenberger Estimator,* which allow to evaluate the induced voltage estimated on the basis of current measurements. The voltage ratio between the estimated voltages of two adjacent coils provides the chariot position independently of the speed.
- *Hall effect sensors,* where the idea is to generate two sinusoidal signals shifted by 90 degrees. The geometry of the magnets has been optimized to obtain a linear position signal.



Transition from method 2 (position measurement with Hall sensor) and method 3 (position estimation based on BEMF)

These last two methods were used. The first one was only used to determine the initial position of the carriage. It is possible to pass from one technique to another "on the fly" (see figure above).

### Conclusions

The key objective of a sensorless measuring of the glider position was fully achieved. The two methods based on the estimation of the BEMF and on the use of Hall-effect sensors were selected. The system is very flexible and allows to switch from one method to the other "on the fly." Furthermore, the communication between the various DSP was obtained reliably and robustly. The McBSP, a highly flexible but relatively not well known communication bus, has been successfully used.

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