

# WEBSMART Motor sizing

## General procedure

The sizing of linear motors is mainly determined by the application-related characteristics of velocity and feed force. First, the user should determine the velocity and force profiles for the required application and set the proper parameters for payload, thrust force, ambient temperature, and axis tilt. Then the choice of motor size is made either by simply calculating the physical limits, or by using a motor sizing application.

One online application for motor sizing is provided at: [Websmart](#)

## Step by step with websmart

### Step 1) Specify the operating conditions of the motor.

For example, enter an external payload of 1.2 kg and select the desired motor type (NL tubular linear motors). Then press the Motion Profile button.

The screenshot shows the 'Linear motor sizing' web application interface. At the top, there is a header with the NiLAB logo and the text 'Linear motor sizing Vers. 3 Rev 022017'. To the right of the header are social media icons for Facebook, YouTube, Twitter, Pinterest, and LinkedIn. Below the header is a dark grey bar with the text 'Operating Conditions' on the left and a 'Project from file' button on the right. The main area contains several input fields and dropdown menus for specifying operating conditions:

- Friction coefficient: 0.01 (unit: N/N)
- Inertial payload: 1.2 (unit: Kg)
- Additional thrust force: 0 (unit: Newton)
- Ambient temperature: 40 (unit: Celsius)
- Axis tilt: 0 (unit: °)
- Servo driver supply: 400 (unit: VAC)
- Requested full stroke: (unit: mm)
- Configuration: Moving magnets (dropdown)
- Motor type: NL miniature tubular (dropdown)
- Guiding system: Nitek Linear Guide type (dropdown)
- N. blocks / rails: (dropdown)

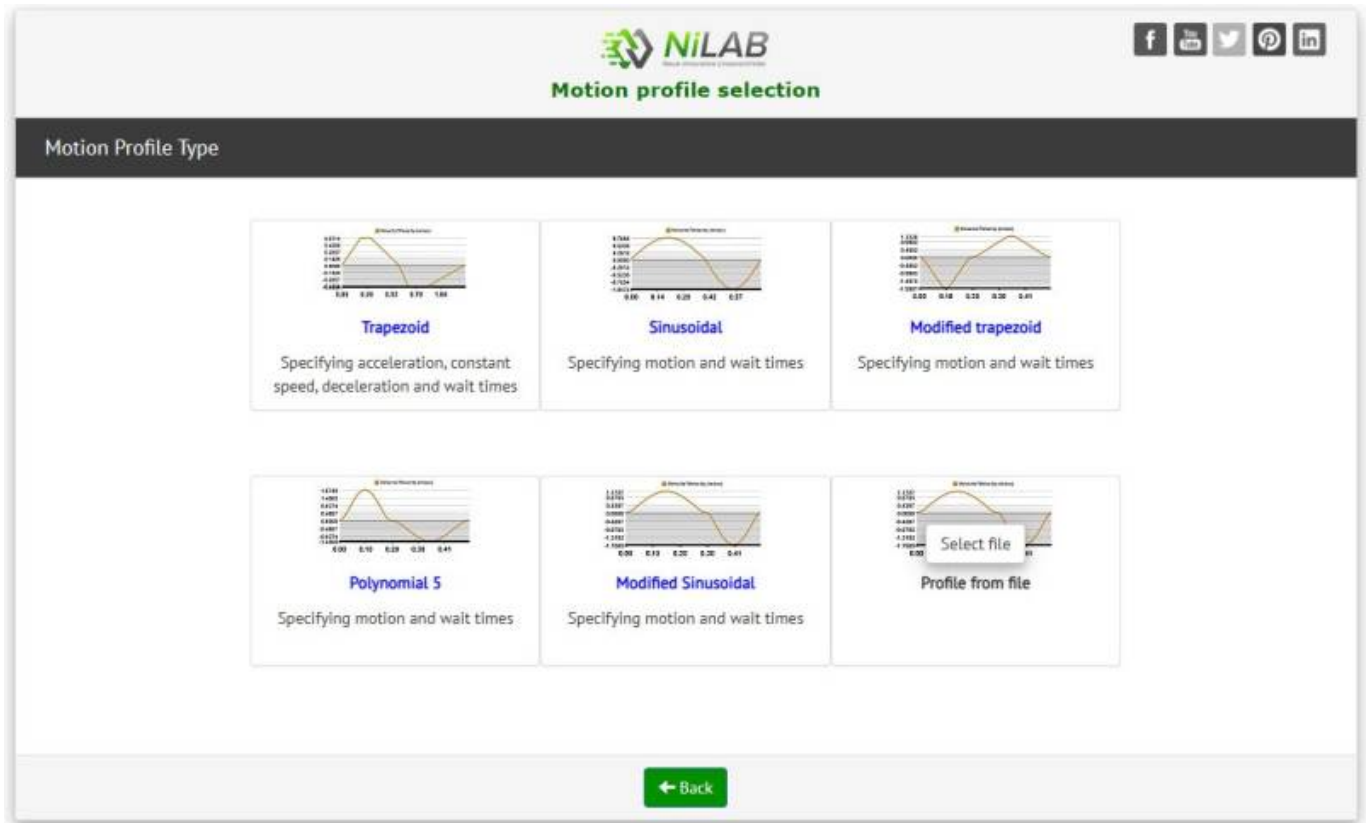
At the bottom of the form are two buttons: 'Cancel' and 'Motion Profile →'.

### Step 2) Select a motion profile.

There are different options for the motion profile type. The simplest is polynomial 5.

It is also possible to upload a cam profile file based on position points. Here is an example motion profile file: [:cam\\_profile\\_example.zip](#)

This example must contain, in the first row, the number of position points; in the second row, the time resolution; and then the position data points, with units in meters.



### Step 3) Create a polynomial 5 motion profile

As an example, we selected the Polynomial 5 motion profile. The motor will move from 0 to 10 mm, with a cycle time of 0.2 s and a waiting time of 0.1 s. Press the Add segment button to update the motion cycle.

Motion profiles



Motion Profile Type: Polynomial 5

Motion profile specifications

Movement

10

mm

Dwell time

0.1

sec

Cycle time

0.2

sec

Repetitions

1

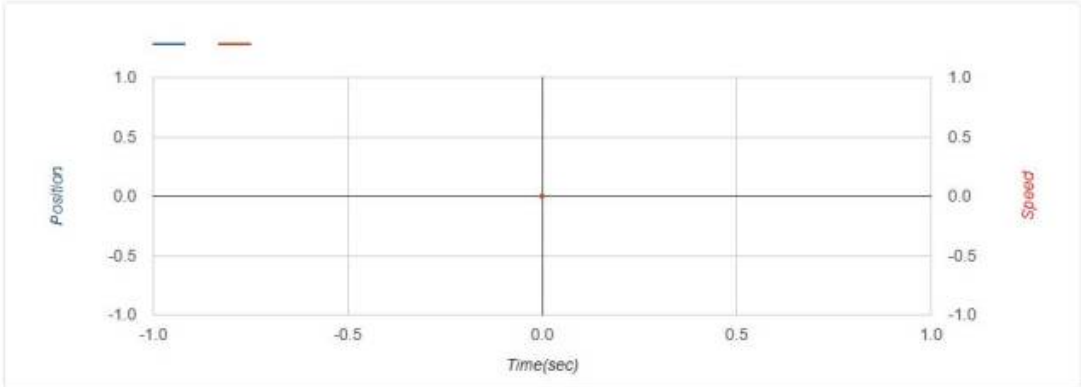
+ Add segment

Current position [m]

0

Current cycle time [s]

0



Split chart

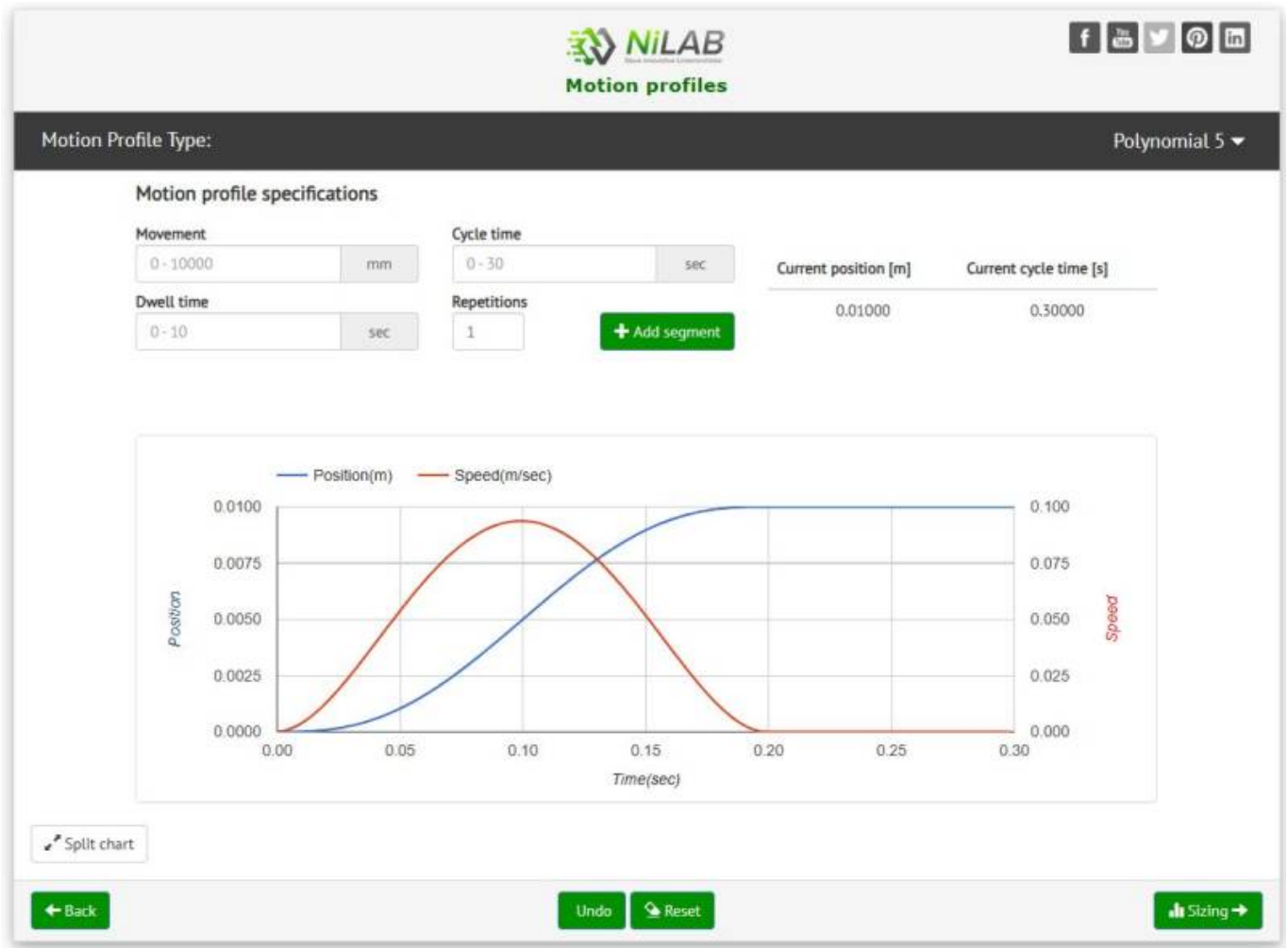
Back

Undo

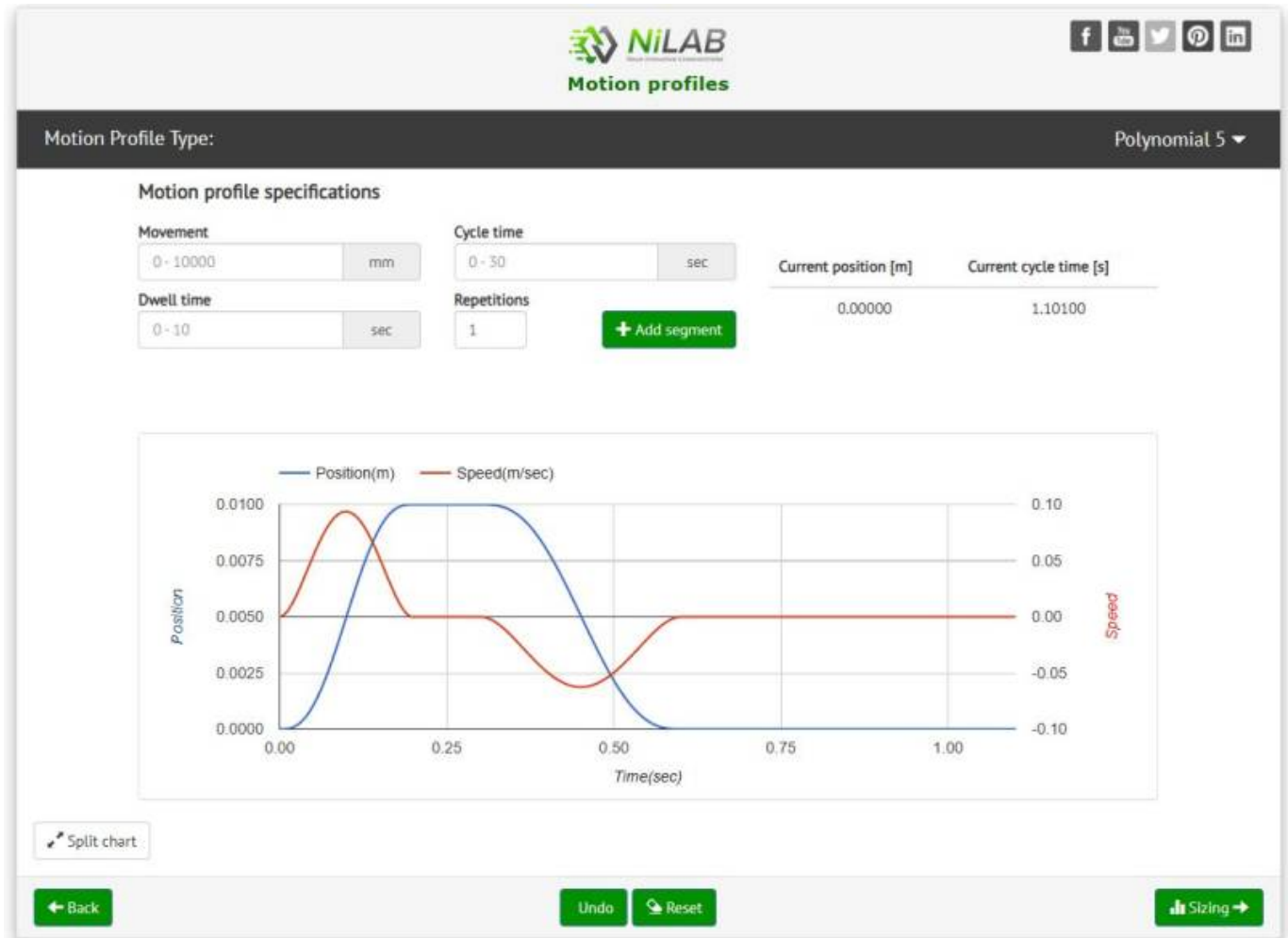
Reset

Sizing

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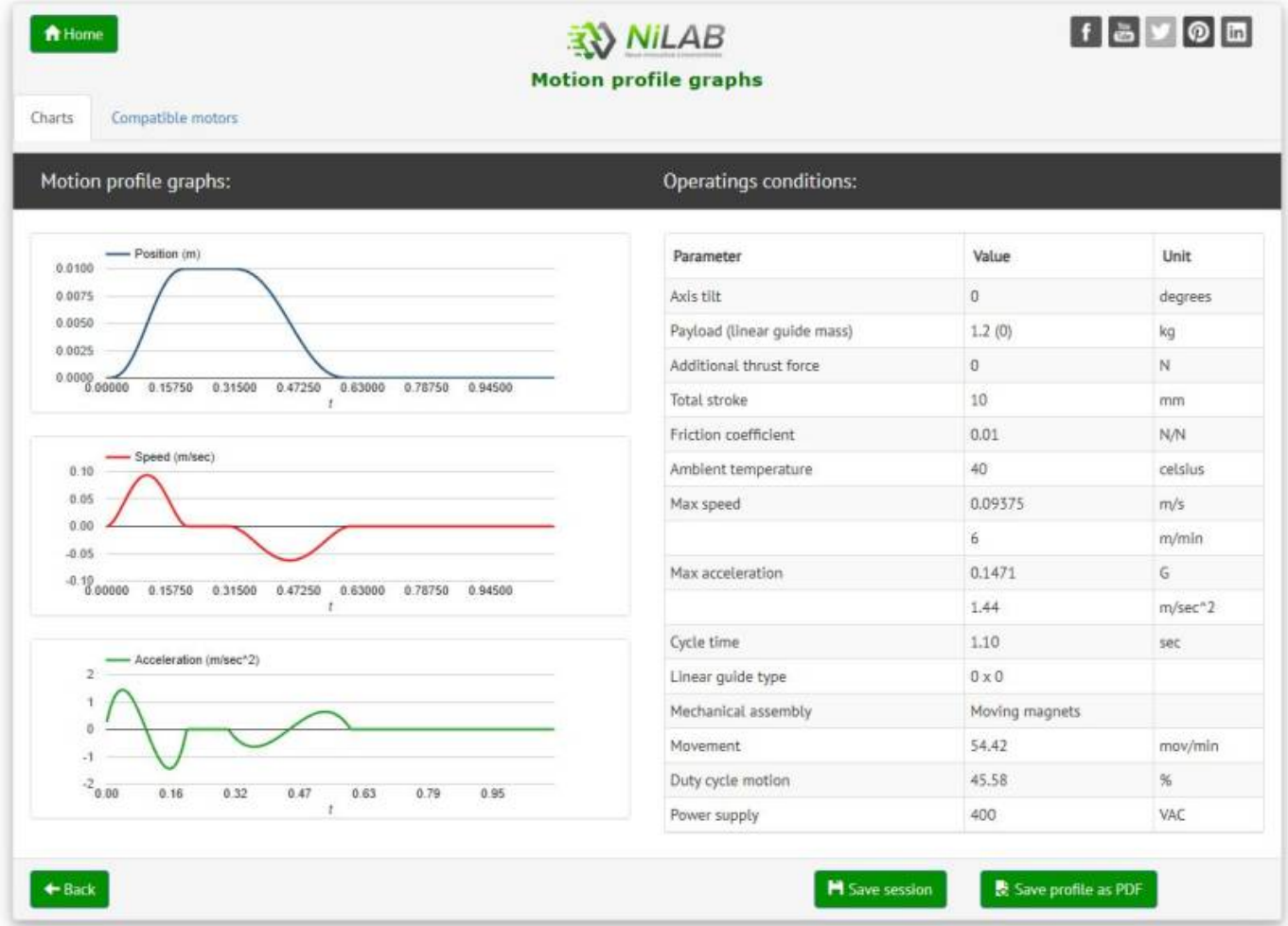


Then we move back 10 mm with different timing.



**Step 4) When the motion cycle is complete, press the Sizing button to go ahead.**

A summary window with all the application data is shown.



Step 5) Compatible motors

Click on the Compatible motor folder: a list of compatible motors is shown.

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Charts

Compatible motors

Motion profile graphs

Search

| Motor code     | Magnets Mass | Winding [Celsius] | Temperature [%] | RMS Power [W] | RMS Voltage [kV] | RMS Current [A] | MAX current [A] | RMS Force [N] | MAX force [N] | Motor load [%] |
|----------------|--------------|-------------------|-----------------|---------------|------------------|-----------------|-----------------|---------------|---------------|----------------|
| NL080X         | 0.07         | 41.90             | 31              | 0.26          | 0.00             | 0.19            | 0.57            | 0.72          | 2.16          | 8              |
| NL040Q         | 0.01         | 56.10             | 42              | 1.36          | 0.02             | 0.24            | 0.73            | 0.62          | 1.88          | 56             |
| NL120Q4P       | 0.90         | 63.94             | 47              | 13.30         | 0.01             | 2.52            | 3.23            | 10.57         | 13.56         | 50             |
| NL120Q         | 0.15         | 40.12             | 30              | 0.05          | 0.00             | 0.07            | 0.21            | 0.89          | 2.52          | 4              |
| NL040X         | 0.01         | 47.93             | 36              | 0.69          | 0.01             | 0.24            | 0.73            | 0.62          | 1.89          | 30             |
| NL120X         | 0.24         | 40.11             | 30              | 0.05          | 0.00             | 0.10            | 0.27            | 1.11          | 2.92          | 3              |
| NL120X-FC-S157 | 0.36         | 42.09             | 31              | 4.19          | 0.01             | 0.97            | 1.17            | 10.55         | 12.78         | 15             |
| NL080Q4P       | 0.05         | 42.91             | 32              | 0.36          | 0.00             | 0.32            | 0.96            | 0.68          | 2.06          | 13             |
| NL080Q         | 0.05         | 43.74             | 32              | 0.47          | 0.01             | 0.18            | 0.54            | 0.68          | 2.06          | 13             |

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Save session

Save profile as PDF

## Step 6) Performance and limits check

Click on the motor code: the diagram showing the motor limits and the requirements is displayed.



## Step 7) Check safety margin

Click on the Parameter tables: the safety margin for the motor performance is displayed.





Motor code: NL080X-10



Charts

Parameter tables

MOTOR DATA

| Parameter             | Value          |
|-----------------------|----------------|
| Phase Resistance      | 4.86 ohm       |
| Phase Inductance      | 0.6 mH         |
| Force constant        | 3.79 N/A       |
| Rated current         | 2.44 Arms      |
| Back EMF              | 2.19 V/m/s     |
| Rated Power           | 27 W           |
| Electrical constant   | 0.12 msec      |
| Motor constant        | 0.34 N/radq(W) |
| Motor shaft length Ls | 198 mm         |
| Motor length F        | 176 mm         |
| Motor dlmension H     | 50 mm          |

ENERGY SAVING DATA(BETA Version)

| Parameter               | Value           |
|-------------------------|-----------------|
| Pneumatic cylinder      | 120603          |
| Air pressure            | 3 bar           |
| Cylinder outer diameter | 12 mm           |
| Cylinder rod diameter   | 6 mm            |
| Cylinder force          | 229 N           |
| Air consumption         | 0.008 nL/cycle  |
| Compressor cost         | 0.012 Euro/m^3  |
| Air consumption cost    | 2.86 Euro/year  |
| Motor consumption cost  | 28.38 Euro/year |
| Energy saving           | -892.3 %        |
| CO2 Saving              | -119 Tons/year  |

PARAMETERS AND MARGINS OVERVIEW

| Motor Parameter | Value      | Request by application  | Value    | Safety margin |
|-----------------|------------|-------------------------|----------|---------------|
| Peak force      | 41.33 N    | Requested Peak Force    | 2.16 N   | 94.77 %       |
| RMS force       | 9.25 N     | Requested RMS Force     | 0.72 N   | 92.22 %       |
| Servo DCBUS     | 565.60 VDC | Requested DCBUS voltage | 4.49 VDC | 99.21 %       |

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