## Goal

* The Goal of this document is to provide an experimental procedure to collect data to confirm in-process parameter identification.

## Measurement Methodology:

* Feed Drive
  + The output of the feed drive will be measured as position of the X and/or Y axis. The number of axes measured will depend on the trajectory of the test. For the slotting tests listed in this document only one axis is required. The encoder data should be the “actual” data (without any pre-processing) to ensure disturbance frequencies are able to be seen in the data.
  + The input to the feed drive will be measured as the current to the feed drive motor. The current monitored should be in the same axis as the slotting direction. The current data should be collected as “actual” data.
  + Measurements of the spindle feed rate, “actual” reference velocity, and spindle speed are also required during the tests.
  + The motor constant (Nm/A) or torque gain of the feed drive motors, and ball screw pitch length (mm) are required for the post processing of the data. This data can be found in the motor and ball screw datasheets.
* Table Dynamometer
  + Will be calibrated beforehand and placed under the stock to measure cutting forces during the tests.
* Recording
  + Recording software must be selected that can record the data as described in the above sections.
  + The recorded data should be stored in a format compatible with MATLAB. (I.e., CSV/MAT files).

## Procedure:

1. The identification of the inertia requires the acceleration of the feed drive. To accomplish this, the feed rate will be changed during the slotting operation. The feed rate will change along the length of the slot with regards to the percentage of the slot milled. All values in the table below are in mm/rev/tooth.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Percentage of Slot Distance | 0-16 % | 17-32 % | 33-64 % | 65-80 % | 81-100 % |
| Pattern #1 | 0.08 | 0.09 | 0.10 | 0.09 | 0.08 |
| Pattern #2 | 0.15 | 0.13 | 0.11 | 0.09 | 0.08 |
| Pattern #3 | 0.08 | 0.10 | 0.12 | 0.14 | 0.16 |

1. To maintain consistency with the previous trials the tool should be a 2-fluted, 16-mm diameter flat end mill and the material used should be Aluminum 7050-T7451. For these set of tests, the axial depth of cut should be 2 mm and full immersion of the tool.

1. Given the feed rate patterns and selected spindle speeds, complete the following combinations of trials in the shown order. The air cutting trials are meant to provide tests where the traditional identification method will provide the same results as the kernel based method. The following cutting tests are randomized to limit the effect of tool wear. Additionally, two trials are repeated at the end to measure any change during the course of the experiment.

|  |  |  |
| --- | --- | --- |
| Trial # | Feed Rate Pattern | Spindle Speed (RPM) |
| 1 | 1 | 0 (Air Cut) |
| 2 | 2 | 0 (Air Cut) |
| 3 | 3 | 0 (Air Cut) |
| 4 | 1 | 3000 |
| 5 | 2 | 6000 |
| 6 | 3 | 9000 |
| 7 | 1 | 6000 |
| 8 | 2 | 9000 |
| 9 | 3 | 3000 |
| 10 | 1 | 9000 |
| 11 | 2 | 3000 |
| 12 | 3 | 6000 |
| 13 | 1 | 3000 |
| 14 | 1 | 0 (Air Cut) |