Reproducibility Report for

Jin, Bukkapatnam, Hayes, and Ding, 2023, "Vibration signal-assisted endpoint detection for long-stretch, ultraprecision polishing processes," *ASME Transactions, Journal of Manufacturing Science and Engineering*, Vol.145, pp. 061007.

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1   Computer and software environment

Software used: MATLAB® (R2020b)

Hardware and Operating System: Any operating system capable of installing MATLAB software (Windows/ MacOS/Ubuntu etc.).

2   Explanations of the data files

Experiment1_data folder contains the files of data obtained from the doped surface polishing experiment. The experiment is identified as Experiment #1 in the paper. The files include seven csv files (wpt_P[2..8]_3600ph.csv) of the vibration data—each csv file for one polishing stage—plus one more (the 8th) csv files (Sa_values.csv) of the surface roughness data.

In each of the "wpt_P[2..8]_3600ph.csv" file, the vibration data we share is the vibration energy in frequency domain converted from the original signals in time domain. Here we share the converted data rather than the original data to save space. Had we shared the original vibration data, which are in 10K Hz and last 24 hours per stage, it takes up 135 Gigabytes in storage. The time- to frequency-domain conversion is carried out using Wavelet Package Decomposition, implemented with a built-in MatLab function, *wpt()*. The code to reproduce the conversion is in "wpd_rawtobands.m". The vibration energy data in each of the "wpt_P[2..8]_3600ph.csv" files is saved in a 16-by-16,384 matrix with each row for one of the 16 frequency band (i.e., $[0, 312.5)$, $[312.5, 625)$, $[625, 937.5)$, $[937.5, 1250)$, $[1250, 1562.5)$, $[1562.5, 1875)$, $[1875, 2187.5)$, $[2187.5, 2500)$, $[2500, 2812.5)$, $[2812.5, 3125)$, $[3125, 3437.5)$, $[3437.5, 3750)$, $[3750, 4062.5)$, $[4062.5, 4375)$, $[4375, 4687.5)$, $[4687.5, 5000) Hz$, respectively) and each column recording the average energy of signals every five minutes.

In the "Sa_values.csv" file, the average roughness data is reported in a 7-by-21 matrix of Sa values with rows for polishing stages and columns for inspection locations. For example, the cell on row 2, column 3 is the Sa value at location 3 after polishing in Stage 2.

Experiment2_data folder contains the data obtained from the undoped surface polishing experiment. The experiment is identified as Experiment #2 in the paper. The data specification is the same as Experiment1_data.

Table 1 summaries the data files and their names in each data folder.

Table 1: Data files and names

Data folder name	Number of files	File names
Experiment1_data	8 csv files	wpt_P[2..8]_3600ph.csv Sa_values.csv
Experiment2_data	8 csv files	wpt_P[1..7]_3600ph.csv Sa_values.csv

3 Reproducing the results in the main paper

For the explanation of the input data, please refer to Section 2.

Table 2: Reproducing the results in the paper

To reproduce	Input data file	Code file	Output
Figure 3	Experiment1_data/ wpt_[...].csv files	Figure3_code.m	A figure as Figure 3 plotted with 16 panels, each for one of the 16 frequency bands
Figure 4	Experiment1_data/ wpt_[...].csv files	Figure4_code.m	Three png figure files of Figure 4a, 4b, and 4c, respectively
Figure 5a	Experiment1_data/ Sa_values.csv	Figure5a_code.m	Figure 5a in a png file
Figure 5b	Experiment2_data/ Sa_values.csv	Figure5b_code.m	Figure 5b in two png files
Figure 6a	Experiment1_data/ wpt_[...].csv files	Figure6a_code.m	Figure 6a in a png file
Figure 6b	Experiment2_data/ wpt_[...].csv files	Figure6b_code.m	Figure 6b in a png file
Figures 7-10	Experiment1_data Experiment2_data	Figures7to10_code.m FuncLR_training_engine.m funcLR_combfreq.m train_threshold.m ghatt.m	Six png files for Figures 7a, 7b, 8a, 8b, 9a, 9b, and 10, respectively
Figure 11a	Experiment1_data/ all files	Figure11a_code.m	Figure 11a in a png file
Figure 11b	Experiment2_data/ all files	Figure11b_code.m	Figure 11b in a png file
Figure 12	Experiment1_data	Figures12to15_code.m setting *Figure=12, Subfigure='a','b','c'*.	Three png files for Figures 12a, 12b, 12c, respectively
Figure 13	Experiment2_data	Figures12to15_code.m setting *Figure=13, Subfigure='a','b','c'*.	Three png files for Figures 13a, 13b, 13c, respectively
Figure 14	Experiment1_data	Figures12to15_code.m setting *Figure=12, Subfigure='n'*.	Six png files for Figure 14
Figure 15	Experiment2_data	Figures12to15_code.m setting *Figure=13, Subfigure='n'*.	Six png files for Figure 15