Controlling Engine System: a Low-Dimensional Dynamics in a Spark Ignition Engine of a Motorcycle

Kazuhiro Matsumoto[a], Ichiro Tsuda[a,b], and Yuki Hosoi[c]

[a] Hokkaido University, Department of Mathematics, Kita 10 Nishi 8, Kita-ku,
Sapporo 060-0810, Japan
[b] Hokkaido University, Research Institute for Electronic Science, Kita 12 Nishi 6, Kita-ku,
Sapporo 060-0812, Japan
[c] Yamaha Motor Co., Ltd., Technical Development Division, 2500 Shingai, Iwata 438-8501, Japan

Reprint requests to K. M.; Fax: +81-11-706-2636; E-mail: matsumoto@math.sci.hokudai.ac.jp

We analyze a time series of the combustion pressure in the idle state, measured from a spark ignition engine of a motorcycle. It is clarified that the engine system can be described by a low-dimensional deterministic dynamics perturbed by some stochastic process. We also propose a method to stabilize the chaotic behaviour of engine's data by adopting the Pyragas' method. We actually use this method in a computer experiment for the control of combustion pressure data to demonstrate the efficiency of the proposed method. As a result of the experiment, we eliminate the fluctuations in the combustion pressure data and obtain a periodic orbit.