Adaptive feedforward control of exhaust recirculation in large diesel engines - DTU Orbit
(22/12/2018)

Adaptive feedforward control of exhaust recirculation in large diesel engines

Environmental concern has led the International Maritime Organization to restrict NOx emissions from marine diesel engines. Exhaust gas recirculation (EGR) systems have been introduced in order to comply to the new standards. Traditional fixed-gain feedback methods are not able to control the EGR system adequately in engine loading transients so alternative methods are needed. This paper presents the design, convergence proofs and experimental validation of an adaptive feedforward controller that significantly improves the performance in loading transients. First the control concept is generalized to a class of first order Hammerstein systems with sensor delay and exponentially converging bounds of the control error are proven analytically. It is then shown how to apply the method to the EGR system of a two-stroke crosshead diesel engine. The controller is validated by closed loop simulation with a mean-value engine model, on an engine test bed and on a vessel operating at sea. A significant reduction of smoke formation during loading transients is observed both visually and with an opacity sensor.

General information
State: Published
Organisations: Department of Electrical Engineering, Automation and Control, Linköping University, MAN Diesel & Turbo
Contributors: Nielsen, K. V., Blanke, M., Eriksson, L., Vejlgaard-Laursen, M.
Pages: 26-35
Publication date: 2017
Peer-reviewed: Yes

Publication information
Journal: Control Engineering Practice
Volume: 65
ISSN (Print): 0967-0661
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Scopus rating (2017): CiteScore 3.42 SJR 1.069 SNIP 1.876
Web of Science (2017): Impact factor 2.616
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 3.42 SJR 1.076 SNIP 2.117
Web of Science (2016): Impact factor 2.602
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): CiteScore 3.05 SJR 1.116 SNIP 2.067
Web of Science (2015): Impact factor 1.83
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): CiteScore 3.26 SJR 1.205 SNIP 2.502
Web of Science (2014): Impact factor 1.814
BFI (2013): BFI-level 2
Scopus rating (2013): CiteScore 3.5 SJR 1.339 SNIP 3.154
Web of Science (2013): Impact factor 1.912
ISI indexed (2013): ISI indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): CiteScore 3.02 SJR 1.164 SNIP 3.054
Web of Science (2012): Impact factor 1.669
ISI indexed (2012): ISI indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): CiteScore 2.96 SJR 1.405 SNIP 2.865
Web of Science (2011): Impact factor 1.481
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 2