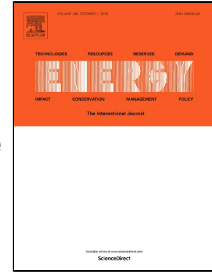


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A novel prediction intervals method integrating an error and self-feedback extreme learning machine with particle swarm optimization for energy consumption robust prediction



Yuan Xu, Mingqing Zhang, Liangliang Ye, Qunxiong Zhu, Zhiqiang Geng, Yan-Lin He, Yongming Han

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1 **A novel prediction intervals method integrating an error & self-feedback extreme learning**
2 **machine with particle swarm optimization for energy consumption robust prediction**

3 Yuan Xu ^{a,b}, Mingqing Zhang ^{a,b}, Liangliang Ye ^{a,b}, Qunxiong Zhu ^{a,b}, Zhiqiang Geng ^{a,b}, Yan-Lin He ^{a,b,*}, Yongming Han ^{a,b,*}

4 ^a College of Information Science and Technology, Beijing University of Chemical Technology, Beijing 100029, China;

5 ^b Engineering Research Center of Intelligent PSE, Ministry of Education of China, Beijing 100029, China;

6 To whom correspondence should be addressed: Emails: heyl@mail.buct.edu.cn (Y.L. He); hanym@mail.buct.edu.cn (Y.M. Han);

7 **Abstract:** Nowadays, petrochemical industries with many integrated units and equipment have
8 characteristics of high uncertainty and nonlinearity. Therefore, it becomes more and more difficult
9 to make reliable and accurate point measurement of energy modeling. To tackle this problem, a
10 novel prediction intervals (PIs) method integrating error & self-feedback extreme learning machine
11 (ESF-ELM) with particle swarm optimization (PSO) is proposed. For improving the energy
12 modeling accuracy of extreme learning machine (ELM), the input weights are initialized using
13 cosine similarity coefficients but not randomly initialized. In addition, an error-feedback layer and
14 a self-feedback layer are added to the input layer and the hidden layer for enhancing generalization
15 performance, respectively. Finally, PSO with a comprehensive measure is developed to evaluate
16 the mean coverage probability and the mean width percentage of PIs. The proposed ESF-ELM with
17 PSO is applied to constructing PIs of energy consumption for a Purified Terephthalic Acid
18 production process. Simulation results show the proposed model can generate high-quality PIs with
19 large coverage probability, narrow width, and superiority in adaptability and reliability, which
20 provides guidance for decision makers to maximize benefits and give reasonable future plans.

21 **Keywords:** Prediction Intervals; Energy consumption prediction; Extreme learning machine;
22 Particle swarm optimization; Petrochemical industries.

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