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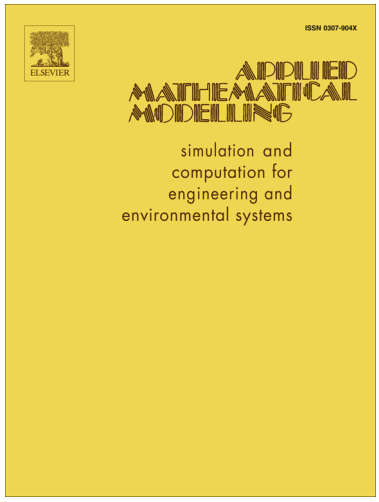

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Integrating Support Vector Regression with Particle Swarm Optimization for Numerical Modelingfor Algal Blooms of Freshwater

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Abstract: Algae-releasing cyanotoxins are cancer-causing and very harmful to the human being. Therefore, it is of great significance to model how the algae population dynamically changes in freshwater reservoirs. But the practical modeling is very difficult because water variables and their internal mechanism are very complicated and non-linear. So, in order to alleviate the algal bloom problems in Macau Main Storage Reservoir (MSR), this work proposes and develops a hybrid intelligent model combining Support Vector Regression (SVR) and Particle Swarm Optimization (PSO) to yield optimal control of parameters that predict and forecast the phytoplankton dynamics. In this process, collected data for current month's variables and previous months' variables are used for model predict and forecast, respectively. In the correlation analysis of 23 water variables that monitored monthly, 15 variables such as alkalinity, Bicarbonate (HCO_3^-), dissolved oxygen (DO), total Nitrogen (TN), turbidity, conductivity, nitrate, suspended solid (SS) and total organic carbon (TOC) are selected, and data from 2001 to 2008 for each of these selected variables are used for training, while data from 2009 to 2011 which are the most recent three years are used for testing. It can be seen from the numerical results that that the prediction and forecast powers are respectively estimated at approximately 0.767 and 0.876, and naturally it can be concluded that the newly proposed PSO-SVR is working well and can be adopted for further studies.

Keywords: Algal bloom; Phytoplankton Abundance; Support Vector Regression; Particle Swarm Optimization; Prediction and Forecast models.

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