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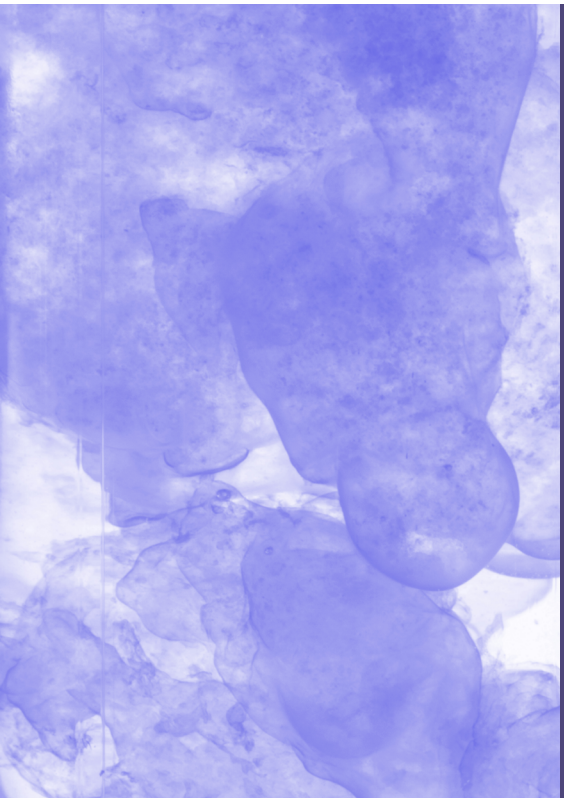

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Selected Papers

Marine Vessel Classification and Multivariate Trajectories Forecasting Using Metaheuristics-Optimized eXtreme Gradient Boosting and Recurrent Neural Networks

Authors: Aleksandar Petrovic, Robertas Damaševičius, Luka Jovanovic, Ana Toskovic, Vladimir Simic, Nebojsa Bacanin, Miodrag Zivkovic and Petar Spalević

Abstract: This work explored the potential of data-driven techniques and applied artificial intelligence (AI) to tackle two challenges. First, vessel classification was explored through the use of extreme gradient boosting (XGboost). Second, vessel trajectory time series forecasting was tackled through the use of long-short-term memory (LSTM) networks. Finally, due to the strong dependence of AI model performance on proper hyperparameter selection, a boosted version of the well-known particle swarm optimization (PSO) algorithm was introduced specifically for tuning the hyperparameters of the models used in this study. The introduced methodology was applied to real-world automatic identification system (AIS) data for both marine vessel classification and trajectory forecasting. The performance of the introduced Boosted PSO (BPSO) was compared to contemporary optimizers and showed promising outcomes. The XGBoost model tuned using boosted PSO attained an overall accuracy of 99.72% for the vessel classification problem, while the LSTM model attained a mean square error (MSE) of 0.000098 for the marine trajectory prediction challenge.

https://doi.org/10.3390/app13169181

Motion Control of Autonomous Underwater Helicopter Based on Linear Active Disturbance Rejection Control with Tracking Differentiator

Authors: Haoda Li, Xinyu An, Rendong Feng and Ying Chen

Abstract: As a new disk-shaped autonomous underwater vehicle (AUV), the autonomous underwater helicopter (AUH) is devoted to subsea operations, usually diving into the seabed and docking with a subsea docking system. Due to the motion control's performance, the AUH's stability and steady-state accuracy are affected remarkably while docking. Moreover, considering the difficulties of hydrodynamic modeling of AUHs, the classical model-based control method is unsuitable for AUHs. Moreover, there is a large gap between the hydrodynamic simulation results and real situations. Hence, based on the data-driven principle, the linear active disturbance rejection control with a tracking differentiator (LADRC-TD) algorithm is employed for AUH depths and heading control. As the simulation experiments prove, LADRC and LADRC-TD have better anti-interference performance when compared with PID. According to the pool experiments, overshoots of the LADRC-TD are 20 cm and 3° for the depth control and heading control, respectively, which are superior to PID and LADRC. Meanwhile, the steady-state accuracy of the LADRC-TD is ±21 cm and ±2.5° for the depth and heading control, respectively, which is inferior to PID and the same as LADRC.

https://doi.org/10.3390/app13169181

Evaluation of Fire Resistance of Polymer Composites with Natural Reinforcement as Safe Construction Materials for Small Vessels

Authors: Katarzyna Bryll, Ewelina Kostecka, Mieczysław Scheibe, Renata Dobrzyńska, Tomasz Kostecki, Wojciech Ślączka and Iga Korczyńska

Abstract: In small vessels, for example, yachts, polymer–glass composites are mainly used for their construction. However, the disposal and/or recycling of composite units is very difficult. It is advisable to solve the problem of disposing of post-consumer items as soon as possible. Therefore, alternative, environmentally friendly, but also durable and safe construction materials are being sought. Such materials can be polymer–natural composites, which can be used as a potential material (alternative to polymer–glass composites) for the construction of small vessels. However, its performance properties should be investigated as new construction materials. The possibility of using polymer–hemp composites was assessed in terms of safety, i.e., the fire resistance of these materials. This paper compares selected characteristics that the reaction of composite materials has to fire with glass fiber and hemp fiber reinforcements. During the study, a natural composite reinforced with hemp fabric was investigated. Based on the laboratory test, it was found that this composite showed better susceptibility to energy recycling, with a relatively small deterioration in fire resistance compared to the composite reinforced with glass fiber. This material could therefore be a potential construction material for small vessels if we consider fire resistance in terms of the safety of the vessel's operation.

https://doi.org/10.3390/app13105832

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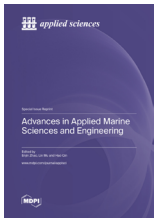

Advances in Applied Marine Sciences and Engineering

Sustainability in Maritime Transport: Advances, Solutions and Pending Tasks

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