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Mechanical Properties of 17-4PH Specimens Produced by Additive Manufacturing

Volume 10 · Issue 11 | November 2022

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Machines, Volume 10, Issue 11 (November 2022) – 140 articles

Cover Story (**view full-size image**): The purpose of this research is to study the influence of the processing conditions that affect the final behaviour of specimens made from a 17-4PH composition powder, which is manufactured using the additive technique known as plasma metal deposition. Two walls manufactured from the prealloyed powder were built under two distinct atmospheric conditions (air and argon), with previously optimised manufacturing parameters. The additional effect of two applied thermal treatments was studied by means of property and microstructural analyses of the extracted specimens from each consolidated wall. The two thermal treatments consisted of a heating rate of 10 °C/min to 482 °C and 620 °C, with the temperatures for 1 and 4 h, respectively; the cooling rate was 5 °C/min for both treatments. **View this paper**

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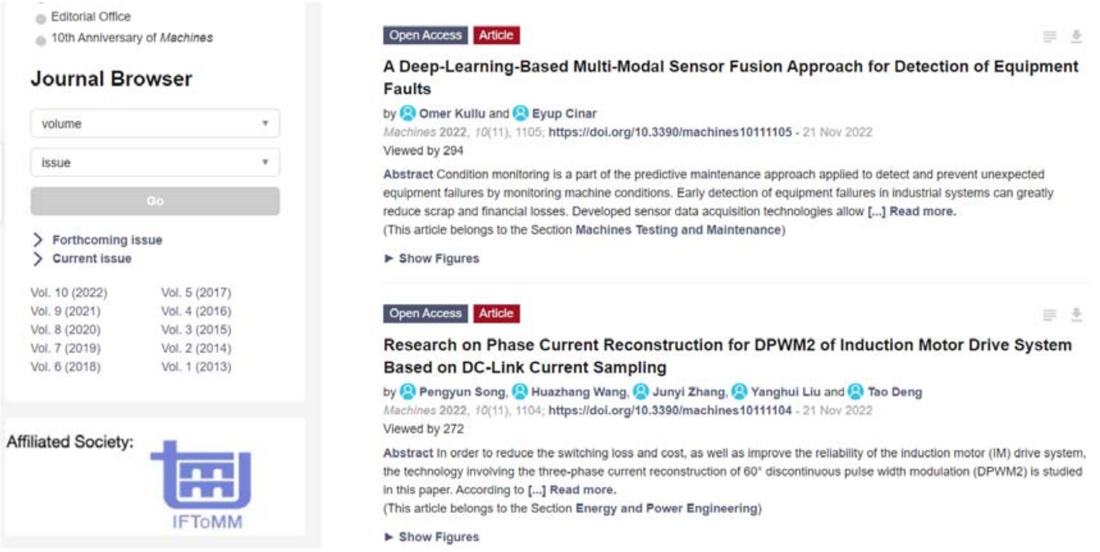

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Open Access Article

A Deep-Learning-Based Multi-Modal Sensor Fusion Approach for Detection of Equipment Faults

by **Omer Kullu** and **Eyup Cinar**

Machines 2022, *10*(11), 1105; **https://doi.org/10.3390/machines10111105** - 21 Nov 2022

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Abstract Condition monitoring is a part of the predictive maintenance approach applied to detect and prevent unexpected equipment failures by monitoring machine conditions. Early detection of equipment failures in industrial systems can greatly reduce scrap and financial losses. Developed sensor data acquisition technologies allow **[...] Read more.**

(This article belongs to the Section **Machines Testing and Maintenance**)

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Research on Phase Current Reconstruction for DPWM2 of Induction Motor Drive System Based on DC-Link Current Sampling

by **Pengyun Song**, **Huazhang Wang**, **Junyi Zhang**, **Yanghui Liu** and **Tao Deng**

Machines 2022, *10*(11), 1104; **https://doi.org/10.3390/machines10111104** - 21 Nov 2022

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Abstract In order to reduce the switching loss and cost, as well as improve the reliability of the induction motor (IM) drive system, the technology involving the three-phase current reconstruction of 60° discontinuous pulse width modulation (DPWM2) is studied in this paper. According to **[...] Read more.**

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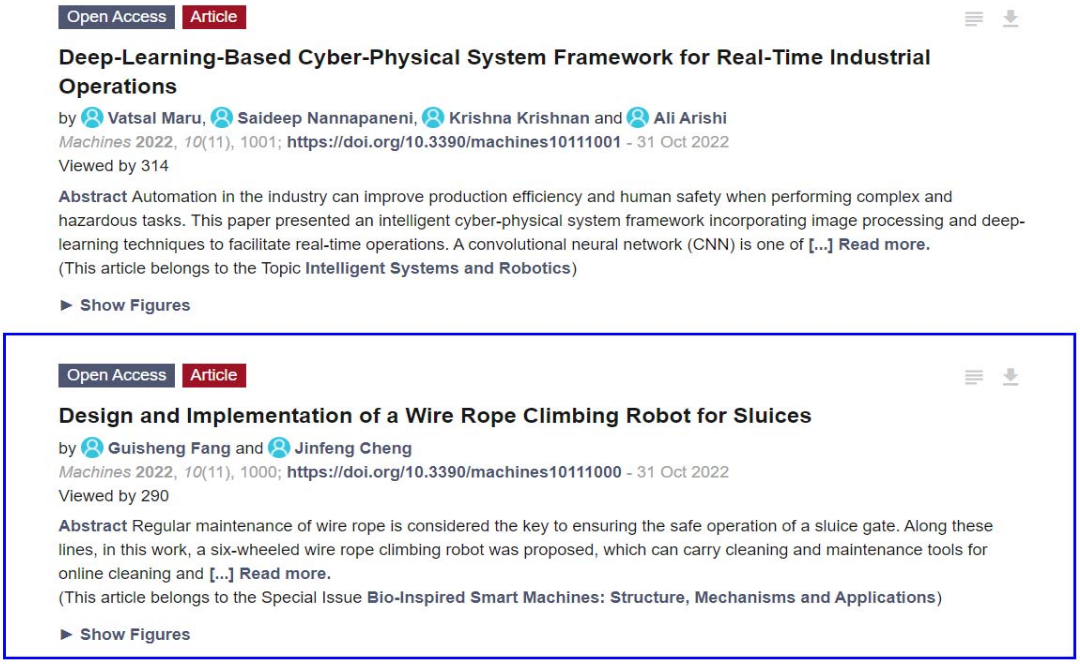

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Deep-Learning-Based Cyber-Physical System Framework for Real-Time Industrial Operations

by **Vatsal Maru**, **Saideep Nannapaneni**, **Krishna Krishnan** and **Ali Arishi**

Machines 2022, *10*(11), 1001; **https://doi.org/10.3390/machines10111001** - 31 Oct 2022

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Abstract Automation in the industry can improve production efficiency and human safety when performing complex and hazardous tasks. This paper presented an intelligent cyber-physical system framework incorporating image processing and deep-learning techniques to facilitate real-time operations. A convolutional neural network (CNN) is one of **[...] Read more.**

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Design and Implementation of a Wire Rope Climbing Robot for Sluices

by **Guisheng Fang** and **Jinfeng Cheng**

Machines 2022, *10*(11), 1000; **https://doi.org/10.3390/machines10111000** - 31 Oct 2022

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Abstract Regular maintenance of wire rope is considered the key to ensuring the safe operation of a sluice gate. Along these lines, in this work, a six-wheeled wire rope climbing robot was proposed, which can carry cleaning and maintenance tools for online cleaning and **[...] Read more.**

(This article belongs to the Special Issue **Bio-Inspired Smart Machines: Structure, Mechanisms and Applications**)

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Article

Design and Implementation of a Wire Rope Climbing Robot for Sluices

Guisheng Fang [1,*] **and Jinfeng Cheng** [1,2]

[1] College of Mechanical and Automotive Engineering, Zhejiang University of Water Resources and Electric Power, Hangzhou 310018, China
[2] School of Electronic Information, Hangzhou Dianzi University, Hangzhou 310018, China
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Abstract: Regular maintenance of wire rope is considered the key to ensuring the safe operation of a sluice gate. Along these lines, in this work, a six-wheeled wire rope climbing robot was proposed, which can carry cleaning and maintenance tools for online cleaning and safety inspection of the sluice wire rope, without its disassembly. The developed climbing robot is composed of separable driving and driven trolleys. It adopts the spring clamping mechanism and the wheeled movement method. Thus, it can easily adapt to the narrow working environment and different diameter ranges of the sluice wire rope. In addition, the designed six-wheeled wire rope climbing robot not only possesses a simple structure, simple control, and stable climbing speed, which are typical characteristics of wheeled climbing robots, but also a large contact area with objects and small wheel deformation, which are typical characteristics of crawler climbing robots. Structural design and mechanical analysis were also carried out, with the fabrication of a prototype robot system called WRR-II. From the acquired experimental results of the prototype's climbing speed test, load capacity test, climbing adaptability test, and obstacle-negotiation ability test, the rationality and feasibility of the designed climbing robot scheme were verified.

Keywords: climbing robot; mechanical analysis; spring clamping; sluice gate; wire rope; wheeled movement

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Citation: Fang, G.; Cheng, J. Design and Implementation of a Wire Rope Climbing Robot for Sluices. *Machines* **2022**, *10*, 1000. https://doi.org/10.3390/machines10111000

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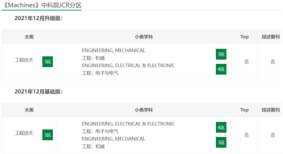
1. Introduction

In water conservancy engineering facilities, sluice gates are widely used in rural and coastal river channels as the main water retaining and discharge structures. As the main load-bearing component of the hoisting sluice, the wire rope plays a vital role in the safe operation of the sluice. Due to the long-term exposure of the sluice wire rope to the outdoors, it is affected by irregular bearing, wind, rain, and sun, which will lead to various problems, such as grease hardening, local corrosion, wear, and breakage. Therefore, regular maintenance is essential for the proper operation of the wire rope. Currently, most of the daily maintenance of the sluice wire rope is done manually, leading to problems, such as high labor cost and intensity, low work efficiency, and high-risk factor. With the application of the scientific and technological developments in the field of robotics to the daily maintenance process of the wire rope, the above-mentioned problems can be easily solved. Therefore, the research and development of a wire rope climbing and maintenance robot in the water conservancy industry are anticipated to significantly improve work efficiency in this field, successfully addressing the labor issue in enterprises.

As an important branch of the mobile robot family, climbing robots have received widespread attention from the scientific community in the past two decades. As a result, a wide variety of prototype systems have been developed for specific applications, such as steel bridge climbing robots [1–4], cable-climbing robots [5–8], pole-climbing robots [9–13], tree-climbing robots [14–17], pipe-climbing robots [18,19], wall-climbing robots [20–24], among others.



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