Sustainable Water Management and Treatment: Systems, Processes and Technologies

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Abstract

Global water resources are rapidly diminishing, driven by population growth, climate changeClimate change, and expanding industrialization. Experts estimate that by 2050, 52% of the projected 9.7 billion people worldwide will reside in areas experiencing water stress or scarcity. The global challenge of accessing clean, potable water will persist as sustainable solutions remain elusive. Water sustainabilitySustainability involves meeting the current generation's water needs without jeopardizing future generations' ability to meet their own. Water is the cornerstone of sustainable developmentSustainable development, serving as a common thread linking global challenges such as energy, food securityFood security, health, peace, security, and poverty eradication. Our survival and well-being depend heavily on effective water resource systems. However, with growing development pressures on land in watersheds and increasing demands for water in streams, rivers, lakes, and aquifers, it is unrealistic to expect these water systems to return to or maintain their pristine, most productive states. Sustainable water managementWater management (SWM) is crucial for addressing these pressures and achieving sustainable development goalsSustainable Development Goals (SDGs). SWM ensures that current water needs are met for all users without compromising the ability of future generations to meet their own needs. This concept aligns with broader sustainability principlesSustainability principles, addressing both present and future water challenges. Enhancing the efficiency of conventional membrane technologies for water treatment is now crucial to minimizing their environmental impactEnvironmental impact.

WastewaterWastewater treatmenttreatmentWastewater treatment removes pollutants, coarse particles, and toxic substances while killing pathogens and producing bio-methaneMethane (CH$_4$) and manure for agricultureAgriculture. It is crucial in reducing water waste, easing pressure on natural water sources, and supporting clean energy, forming the foundation for sustainable waste managementWaste management. Membrane technologies are increasingly favored forSustainable wastewater treatmentwastewater treatmentWastewater treatment due to their sustainabilitySustainability advantages, including cost-effectiveness, operational ease, and safety. Sustainable water treatment technologies utilize innovative methods such as membrane filtrationMembrane filtration, advanced oxidation processesAdvanced Oxidation Processes (AOPs), and nanotechnologyNanotechnology. Techniques like reverse osmosisReverse osmosis and ultrafiltration are highly effective in removing contaminantsContaminants, microorganisms, and nanoparticles from water. Sustainable water technologies include wastewater treatmentWastewater treatment plants, intelligent irrigation systems, fog catchers, rainwater harvestingRainwater harvesting, tap aerators, seawater desalinationDesalination, portable filters, and solar-powered desalinationDesalination units. © The Author(s), under exclusive license to Springer Nature Switzerland AG 2025.

Author keywords

Electro deionization; Membrane technology; Water management; Water pollution; Water scarcity; Water Stress Index; Waterborne diseases

Indexed keywords

Engineering controlled terms

Agriculture; Cost effectiveness; Environmental technology; Microfiltration; Population statistics; Potable water; River pollution; Sustainable development; Sustainable development goals; Wastewater treatment; Water conservation; Water filtration; Waterworks

Engineering uncontrolled terms

Electro-deionization; Future generations; Global challenges; Sustainable water; Sustainable water management; Water needs; Water scarcity; Water stress indices; Water-borne disease; Waters managements

Engineering main heading

Membrane technology

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Hindu Code Bill: Towards Liberation of Women

Chaudhary, Poonam ✉

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Abstract

Multiple roles of maternity formed the core of the discourse surrounding the controversial Hindu Code Bill during 1941–1956. In the struggle to reach a social agreement on family laws for the majority Hindu community in modern India, the discourse in the public and legislative scope brought out the split social ethics on maternity in Indian society. The constructive phase of family law reforms also played an important role in the social formation of the identity of maternity. The current revitalization of the discussion on enacting a uniform civil code, which its proponents trust will give all oppressed women equal rights, manages the reality of the discrimination that Hindu women continue to face in spite of alterations in Hindu personal laws, including issues of maintenance and inheritance. Instead of consistency in law oppressed women need an accessible and affordable justice system. Gender equality often stands compromised in several personal laws in India, along with the history of legislature having a non-interfering attitude in altering inequitable personal laws, in order to avoid negotiating on their political vote banks, unless rebuked by the judiciary. © 2016 Indian Institute of Management, Ahmedabad.

Author keywords

legislation; maternity; rebuked; revitalization; Women

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Assessment of Wire Offset While Machining EN-24 on WEDM

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Abstract

Wire offset is the dimensional shift that is experienced while machining a job on Wire-EDM machine. This modeling of wire offset during machining of EN-24 (EN is Euro Norm) was performed implementing Response Surface Methodology (RSM). Factors under consideration are peak current, on duration and off duration of pulse. Scanning Electron Microscopy was later performed for measurement of dimensional shift experienced under various machining conditions. The difference of programmed width and actual width obtained revealed the wire offset of the machined specimen. The tests revealed that Wire-EDM (Wire-Electro Discharge Machine) variables and Wire Offset can be modelled using Quadratic equations. ANOVA (Analysis of Variance) depicted that quadratic term of peak current is crucial parameter for Wire offset trailed by off duration. Keeping medium level of electrical parameters will lead to lower wire offset. Further model validation was performed and the residual error for Wire Offset was found to be 2.43% which suggest the competence of the present model. This is an open access article under the CC BY-NC-SA 4.0 license.

Author keywords

RSM; SEM; WEDM; wire offset

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METEOROLOGICAL AND GEOSPATIAL ANALYSIS-BASED INTEGRATED MACHINE LEARNING FOR ACCURATE AIR QUALITY FORECASTING

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In light of the growing environmental problems caused by low air quality, this investigation offers a thorough approach to precise air quality forecasting. The goal of the research effort is to disentangle the intricate network of variables affecting air quality by fusing state-of-the-art machine learning algorithms with meteorological and geographic data. The investigation acknowledges both man-made and natural air pollution sources, among other diverse sources. The burning of fossil fuels, industry, farming, waste disposal, deforestation, automobile traffic, and indoor sources are all included in the following list. To create accurate forecasting models, a comprehensive data collection process is employed, which includes historical and current datasets from weather sources and monitoring stations. To comprehend spatial connections and trends, spatial analysis is incorporated using Geographic information system (GIS) capabilities. Continuous hyperparameter tuning is carried out while model validation, using measures like Mean absolute error (MAE) and Root mean squared error (RMSE), assures accuracy. In order to provide dynamic forecasting, the created system is integrated into a real-time framework and continuously assimilates updated meteorological and geographical data. Access to stakeholders is facilitated by an intuitive interface, which highlights the environmental consequences of changes in air quality. Working

together with environmental groups, research institutes, and meteorological agencies promotes data exchange and ongoing model improvement. With an emphasis on the effects on the environment, this integrated method offers a comprehensive solution for precise and fast air quality forecasts. This research helps to proactive decision-making in pollution control and sustainable environmental practices by addressing the important requirement for effective environmental management techniques. © 2024, Scibulcom Ltd.. All rights reserved.

Author keywords

air quality forecasting; environmental impacts; geospatial integration; machine learning models; meteorological analysis; sustainable environmental practices

Indexed keywords

GEOBASE Subject Index

accuracy assessment; air quality; data set; environmental impact; environmental management; forecasting method; machine learning; meteorology; spatial analysis; sustainability

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Migration of Electrode Material During Electro Discharge Machining

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Abstract

During the spark transfer from tool to workpiece, the negative ions from tool strike the work surface while the positive ions from work strike the tool surface. The present research elucidates the migration of tool and work material while performing the machining on EDM. The energy dispersive X-ray (EDX) spectroscopy shows the relocation of component of tool material onto the work surface and vice versa. The present investigation depicted that higher discharge energy resulting due to elevated temperature makes the element loosen, and their migration is caused by the positive and negative ions upon the respective surfaces. © 2023, The Author(s), under exclusive licence to The National Academy of Sciences, India.

Author keywords

Cu–W; Deposition; EDM; Spectroscopy

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Modeling of kerf width during WEDM of die steel D3

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Abstract

The present model depicts the kerf width during wire-EDM of Die Steel D3 using zinc coated brass wire. Response Surface Methodology with Central Composite Design is employed and orthogonal array was developed using peak current, pulse on time and pulse off time as the machining parameters. Dependency of wire EDM parameters on kerf width was assessed. Micrograph images were taken and measurements were performed in order to assess the value of Kerf Width. It was found that the Kerf Width is majorly influenced by all the three selected electrical parameters. For Kerf Width, peak current is the most crucial electrical parameter. Higher intensity sparks induces dimensional shift in the work. Model validation was performed using point prediction capability of Design Expert. The residual error for Kerf Width was found to be 1.08% thus suggesting suitability of the model. © 2021

Author keywords

CCD; Kerf width; Micrographic image; RSM; WEDM

Indexed keywords

Engineering controlled terms

Electric network parameters; Zinc coatings

Engineering uncontrolled terms

Brass wire; Die steels; Electrical parameter; Kerf width; Micrographic image; Peak currents; Response-surface methodology; RSM; WEDM; Wire-EDM

Engineering main heading

Wire

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