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Heat transfer intensification with field synergy principle in a fin-and-tube heat exchanger through convex strip installation

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Abstract

Improvement of heat transfer using surface protrusion (convex strip) has been effective recently. Surface protrusion is able to improve flow mixing which increases the rate of heat transfer . Therefore, this study aims to improve the heat transfer in a fin-and-tube heat exchanger by fitting convex strips around the tubes . Three-dimensional modeling was carried out by placing four and eight convex strips around the staggered tubes at a constant temperature of 106°C. The turbulent k–ε model was applied at a Reynolds number range of 3438–15,926. The results of the study indicate that tubes with eight convex strips demonstrated a heat transfer improvement of 40.46%, compared to that with four convex strips. In this case, the TEF is 6.27% higher than the four convex strips. In

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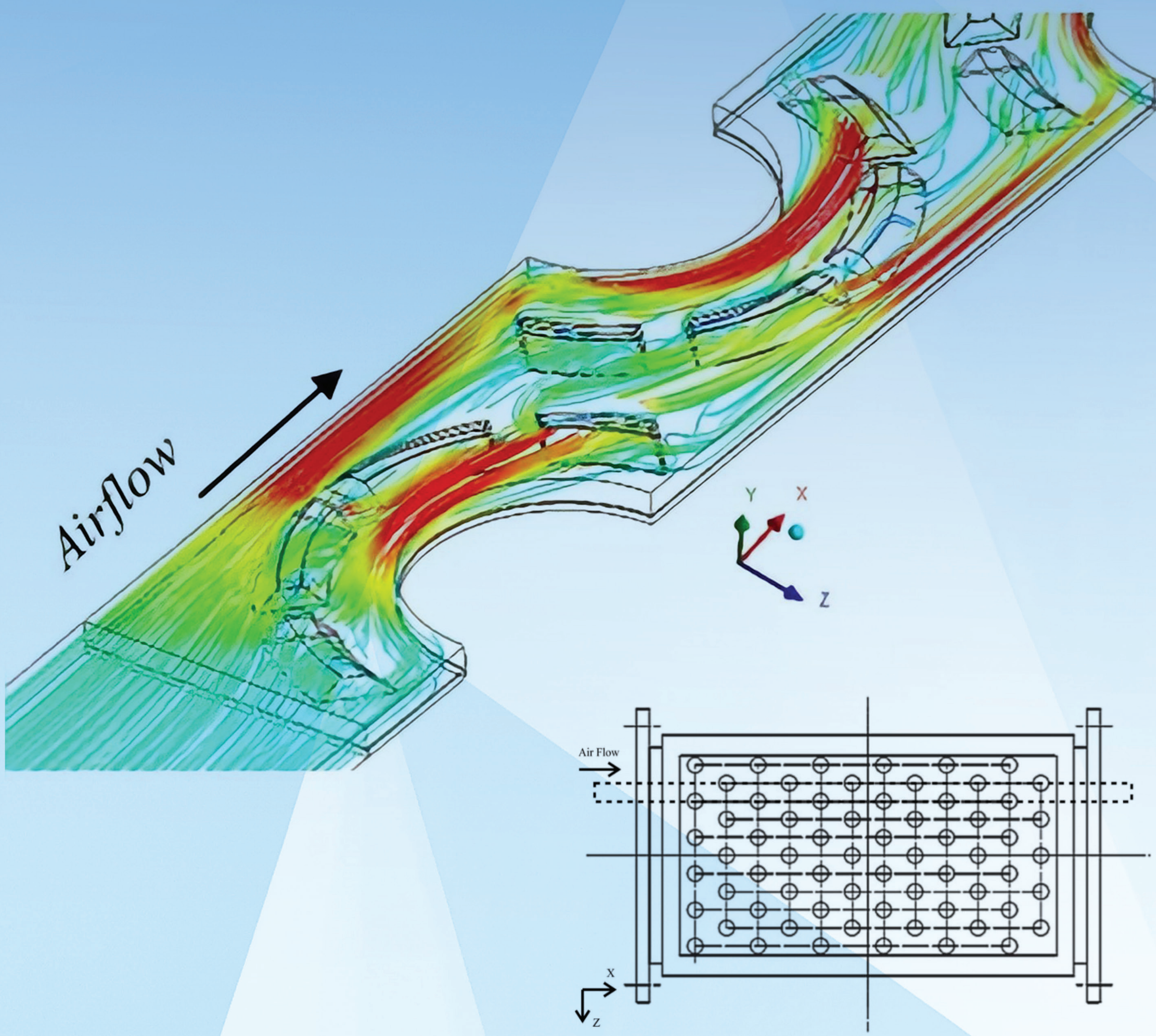

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Heat transfer intensification with field synergy principle in a fin-and-tube heat exchanger through convex strip installation

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FRONT COVER

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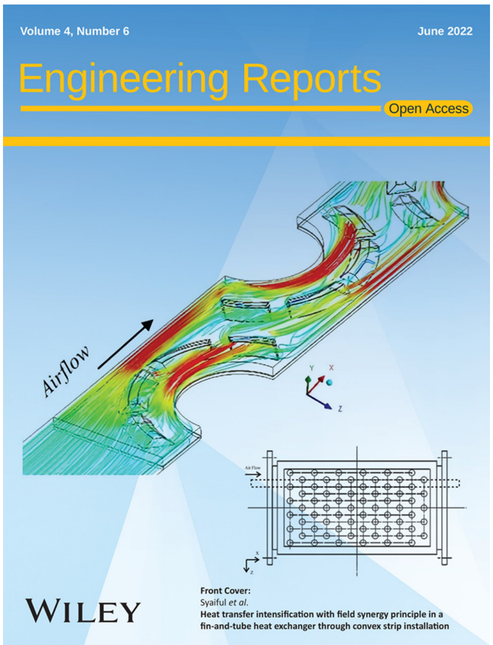
Front Cover Image, Volume 4, Number 6, June 2022

Syaiful, Taufan Anindhito Wicaksono, M. S. K. Tony S. U., Agus Suprihanto, Maria F. Soetanto

First Published: June 2022



The cover image is based on the Research Article Heat transfer intensification with field synergy principle in a fin-and-tube heat exchanger through convex strip installation by Syaiful et al. https://doi.org/10.1002/eng2.12510

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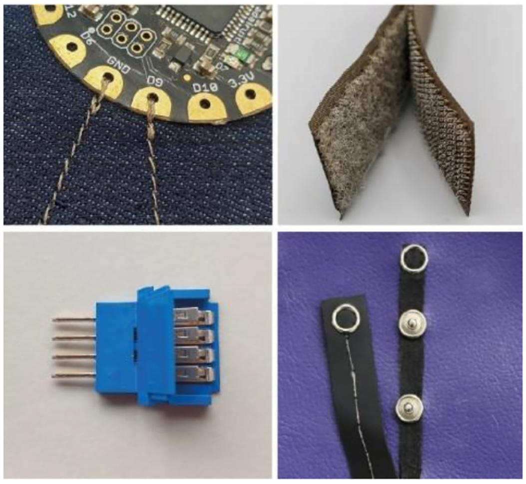
REVIEW

Open Access

A review of connectors and joining technologies for electronic textiles

Jessica Stanley, John A. Hunt, Phil Kunovski, Yang Wei

First Published: 23 December 2021



Materials and technologies that enable joining of electronic textile circuits are an important step in the development of comfortable and durable smart garments. This article reviews the variety of joining methods used to date, covering both detachable and fixed connections, and highlighting the need for new joining technologies designed to meet the specific needs and challenges of electronic textiles.

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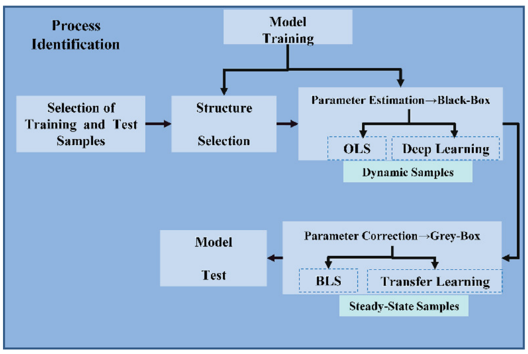
RESEARCH ARTICLES

Open Access

Research on data-driven model for soft sensing of natural gas production system

Dan Wang, Qi Kang, Juheng Yang, Jing Gong, Qi Zhang

First Published: 28 March 2022



The data-driven model bank for gas production well proposed in this research is built through a series of process identification procedures, including samples selection, model structure selection, model parameter estimation, model parameter correction and model test. During model parameter estimation, a variety of black-box models are built based on dynamic samples, where orthogonal least square regression and deep learning technique are introduced to determine the parameters. During model parameter correction, parameters of black-box models are corrected by bi-objective least square algorithm and transfer learning technique with the help of steady-state samples to get corresponding grey-box models.

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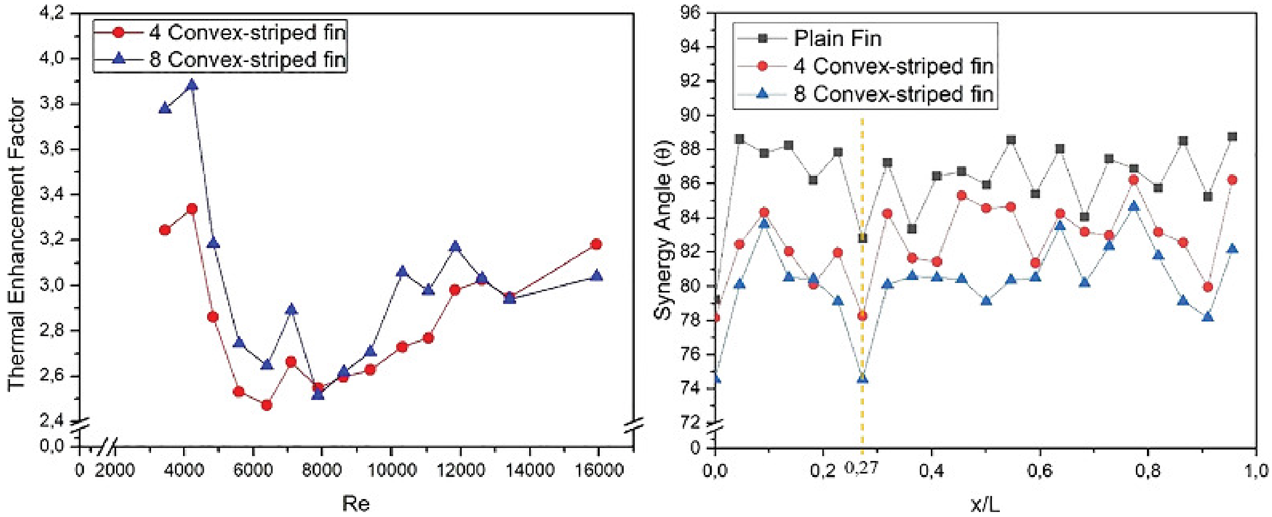
Heat transfer intensification with field synergy principle in a fin-and-tube heat exchanger through convex strip installation

Syaiful, Taufan Anindhito Wicaksono, M. S. K. Tony S. U., Agus Suprihanto, Maria F. Soetanto

First Published: 15 March 2022



Improvement of heat transfer using surface protrusion (convex strip) has been effective recently. Surface protrusion is able to improve flow mixing which increases the rate of heat transfer. Therefore, this study aims to improve the heat transfer in a fin-and-tube heat exchanger by fitting convex strips around the tubes. Three-dimensional modeling was carried out by placing four and eight convex strips around the staggered tubes at a constant temperature of 106°C. The turbulent k–ε model was applied at a Reynolds number range of 3438–15,926. The results of the study indicate that tubes with eight convex strips demonstrated a heat transfer improvement of 40.46%, compared to that with four convex strips. In this case, the TEF is 6.27% higher than the four convex strips. In addition, the synergy angle in the eight convex strips configuration was 0.13% lower than that of the four convex strips configuration. Meanwhile, the flow resistance in the tubes with eight convex strips configurations was 30.96% higher than that of the four convex strips.

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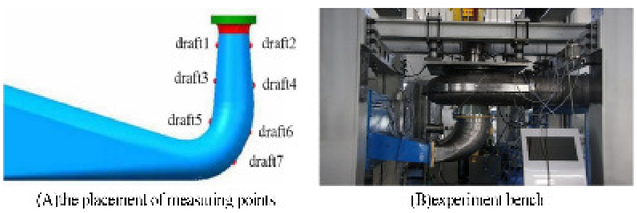
Wavelet and improved Hilbert–Huang transform method are used to study the spectrum distribution and energy of turbine pressure pulsation

Chaofeng Lan, Bowen Song, Shuijing Li, Lei Zhang

First Published: 27 December 2021



In order to reveal the relationship between turbine running state and energy characteristics, wavelet analysis and improved HHT transformation method are used to study the frequency band distribution and energy characteristics of pressure pulsation collected at the tail pipe of the turbine.

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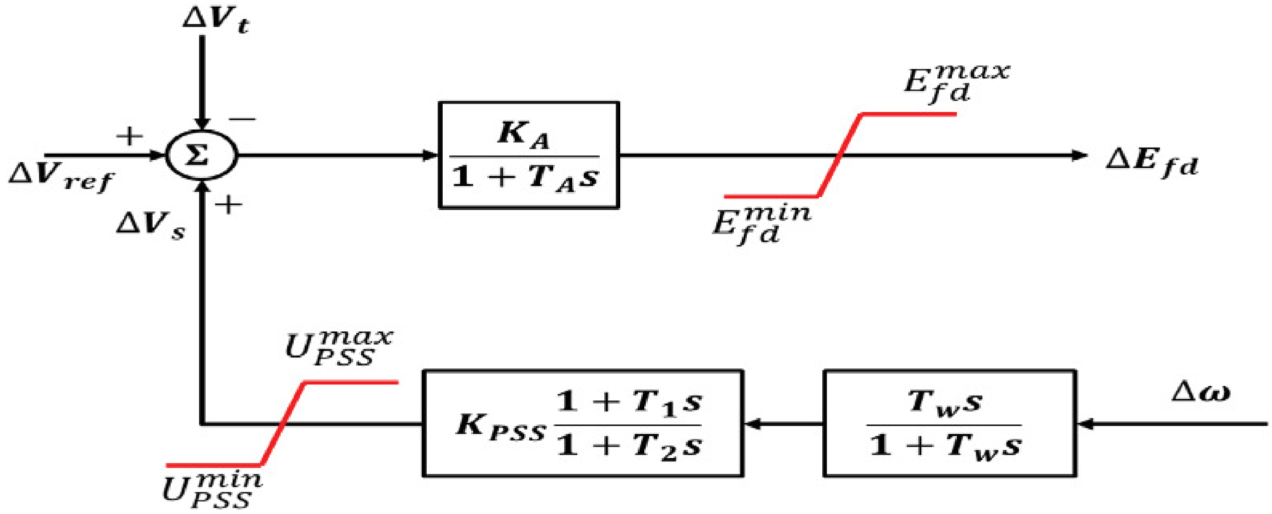
Optimal tuning of fractional-order proportional, integral, derivative and tilt-integral-derivative based power system stabilizers using Runge Kutta optimizer

Mahmoud Abbas El-Dabah, Salah Kamel, Mohammad Ali Yousef Abido, Baseem Khan

First Published: 19 December 2021



This article aims to the optimal tuning of three types of PSS using a recent optimization algorithm called Runge Kutta.

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A generation and distribution system of clock signal source for signal acquisition system

Lei Zhang, Yuanyuan Zhang, Ziqian Shang, Yanrui Su, Fabao Yan, Zhao Wu

First Published: 30 December 2021

	Maximum of output	RMS jitter	PLL quantity	Number of output channels	FOM for PLL
AD9516	2.95GHz	225 fs	One	10 channels	-220dBc/Hz
AD9524	1GHz	200 fs	Two	6 channels	-226dBc/Hz
LMK04808	2.9GHz	111 fs	Two	14 channels	-227dBc/Hz
LMK04828	3.08GHz	88 fs	Two	14 channels	-227dBc/Hz
HMC7044	3.2GHz	44 fs	Two	14 channels	-232dBc/Hz

In this article, a programmable system of clock generator and distribution in microwave frequency band is designed for high-speed acquisition system using dedicated clock chip of HMC7044. Based on the system, a new control program developed by Verilog language, the new configuration method is more concise. Without calling the underlying functions, it can directly control the clock system at the circuit system level.

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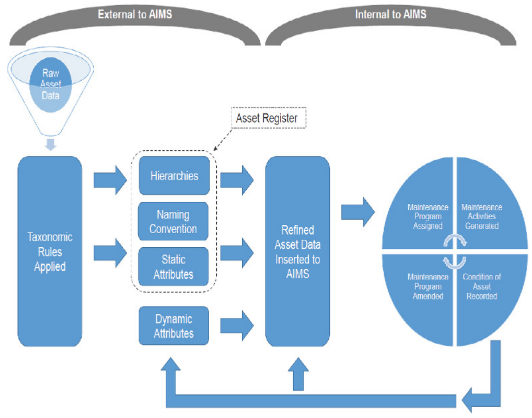
Development of a complementary framework for implementing asset register solutions

Lar English, Akilu Yunusa-Kaltungo, Moray Kidd, Ashraf Labib

First Published: 21 December 2021

The asset register is an important but under-researched aspect of maintenance systems. This article addresses the gaps in the guidance offered in standards to develop an asset register and insert it to an asset information management system.



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DOI: 10.1002/eng2.12510

RESEARCH ARTICLE

Engineering Reports Open Access WILEY

Heat transfer intensification with field synergy principle in a fin-and-tube heat exchanger through convex strip installation

Syaiful[1] | **Taufan Anindhito Wicaksono**[1] | **M. S. K. Tony S. U.**[1] | **Agus Suprihanto**[1] | **Maria F. Soetanto**[2]

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Abstract

Improvement of heat transfer using surface protrusion (convex strip) has been effective recently. Surface protrusion is able to improve flow mixing which increases the rate of heat transfer. Therefore, this study aims to improve the heat transfer in a fin-and-tube heat exchanger by fitting convex strips around the tubes. Three-dimensional modeling was carried out by placing four and eight convex strips around the staggered tubes at a constant temperature of 106°C. The turbulent k–ε model was applied at a Reynolds number range of 3438–15,926. The results of the study indicate that tubes with eight convex strips demonstrated a heat transfer improvement of 40.46%, compared to that with four convex strips. In this case, the TEF is 6.27% higher than the four convex strips. In addition, the synergy angle in the eight convex strips configuration was 0.13% lower than that of the four convex strips configuration. Meanwhile, the flow resistance in the tubes with eight convex strips configurations was 30.96% higher than that of the four convex strips.

KEYWORDS

convection heat transfer coefficient, convex strip, field synergy principle, friction factor, vortex intensity

JEL CLASSIFICATION

Mechanical engineering

1 | INTRODUCTION

Fin-and-tube type heat exchangers have been widely used in various manufacturing industries. In most cases, gas is used as the medium for heat exchange in fin-and-tube heat exchangers; however, the high thermal resistance on the gas side causes a low heat transfer rate. Therefore, the heat transfer rate on the gas side should be improved to increase the efficiency of this type of heat exchanger.[1–3]

Studies have been carried out experimentally and numerically to increase the gas side heat transfer rate in fin-and-tube heat exchangers. One of the methods to increase the heat transfer rate is by manipulating the surface geometry of the fins

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RESEARCH ARTICLE

Engineering Reports Open Access WILEY

Research on data-driven model for soft sensing of natural gas production system

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China University of Petroleum (Beijing) Scientific Research Foundation, Grant/Award Number: 2462020YXZZ045; National Natural Science Foundation of China, Grant/Award Number: 51874323

Abstract
In view of the problems of high cost and low reliability in obtaining operation information such as flow rate and pressure of offshore natural gas production system, research on soft sensing is carried out, and a dynamic data-driven model bank is established, in purpose of estimating single-well flow rate and wellhead pressure, providing convenience tool for online monitoring and system safety analysis. Combining dynamic and steady-state samples, introducing black-box identification techniques including orthogonal least square regression and deep learning along with parameter correction techniques such as bi-objective least square algorithm and transfer learning, a series of nonlinear auto-regressive models with exogenous inputs (NARX) are built, consisting of black-box and gray-box polynomial NARX (Poly-NARX) models as well as deep neural network NARX (DNN-NARX) models, approximately describing the dynamic performance of gas production well. Through realistic operation data, the simulation results of Poly-NARX, DNN-NARX, and multiple-layer-perception-NARX models are compared. It is observed that gray-box DNN-NARX model shows the best performance with advantages of higher global applicability, better approximation ability, and stronger generalization ability. Proposed model bank is of high expansibility and engineering applicability for soft sensing problems in the petroleum industry, laying the ground work for building smart oil and gas field.

KEYWORDS
data-driven soft sensing, deep learning technique, flow management, NARX model, offshore gas production system, process identification, smart oil and gas field

JEL CLASSIFICATION
Industrial engineering

1 | INTRODUCTION

With the development of offshore oil and gas fields, the monitoring of corresponding production systems are faced with severe challenges: complex marine environment, high cost of installation and maintenance for multiphase flow meters, and interference of various errors on the temperature and pressure measurements lead to difficulty in obtaining reliable

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RESEARCH ARTICLE

Engineering Reports Open Access WILEY

Development of a complementary framework for implementing asset register solutions

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Abstract

A correctly compiled asset register within an asset information management system (AIMS) provides the foundation for a successful asset data solution. The lack of correctly structured asset registers within organizations is acknowledged among research and communities of practice. A case study identified anomalies that emerge when using established standards, after which a comprehensive solution for hierarchies, naming conventions and attributes was offered. While standards such as BS ISO 1007 and ISO 14224 provide overarching solution principles, such provisions are not all-encompassing and exist across several sources, which makes the task of developing asset registers error-prone and laborious. Challenges associated with software applications were highlighted through combining personal industrial experience as well as consultations with the existing body of knowledge. Recommendations that enable successful deployment of AIMS, with emphasis on its accommodation of a reliable asset register were then proffered. Scalability was addressed which enables an asset register to expand. This study describes a novel and simplified approach embodied within a single document. Combining the prescriptions of this article with existing literature will ease the delivery of an asset register.

KEYWORDS

asset data, asset hierarchy, asset management, asset register, CMMS, configuration management

JEL CLASSIFICATION

Engineering Education

1 | INTRODUCTION

The creation of asset registers is often overlooked at the project phase by owners and project stakeholders, although they are an essential component of an asset management solution. Data and information handover to the operations phase is left until the completion of the project phase and information is typically handed over in incorrectly structured formats. With this late delivery of unstructured data, it becomes very challenging for owners and asset managers to assess whether the information they need is present and correctly structured. In addition, the transfer of such data and information to the asset information management system (AIMS) is a costly and time consuming process, resulting in extended periods before optimal asset performance can be determined, as optimization decisions (e.g., maintenance, energy, safety) at