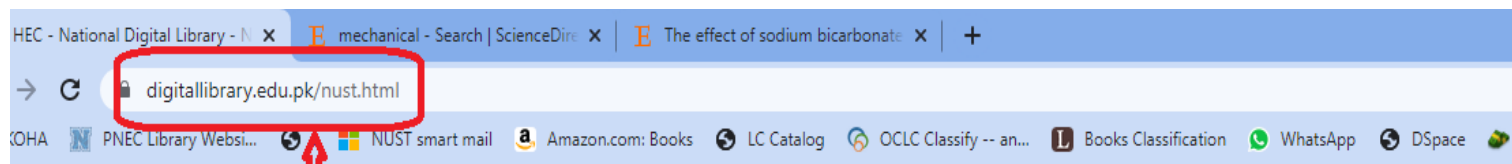


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A Computational Evaluation Approach Based on Design Catalogue for Product Conceptual Design and Its Application in Mechanical Transmission System

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Keywords: Conceptual design, Design catalogue, Robot arm, Evaluation, Mechanical transmission system

Abstract

A principle solution representation model based on design catalogue is proposed. Evaluation system of conceptual design is then built up. A method called Fuzzy Multi-objective Weighted Analytic Hierarchy Process (FMWAHP) is then proposed to realize the evaluation of principle solutions in mechanical products conceptual design. The evaluation of several mechanical transmission system solutions for service robot arm is given as an example, which demonstrates that the methodology is obviously useful for product innovation.

1 Introduction

As mechanical products conceptual design is an early stage of the whole product design process, which has an essential effect on the creativity of product, many researches have been focused on it in recent decades, with a result of many valuable fruits. Current researches can be divided into two basic methods, i.e., problem solving based method and decision-

Design catalogue [1] is the knowledge resource for computer aided conceptual design and even all design stage, whose structure must be suitable for it. Table 1 is an improved design catalogue from our former research [10].

Table 1 An example of partial design catalogue of the parallel friction-rollers mechanism.

ID	No.	6		Name		Parallel Friction Rollers	
Func.	Type_Func	(R→R)		Drive_Rolls	PARALLEL	Drive_Func	OPPOSITE
Main Body	Main Body					Main Parameters: Diameter D1, Diameter D2, ... Main Formula: $l = \frac{D_1}{D_1 - D_2} \cdot \frac{2KT}{m \mu D_1}$	
		Behavior		$\omega_1 \rightarrow \omega_2 \rightarrow \omega_3 (\omega_1, \omega_2, \omega_3)$		Main Effects: Friction Effect, Lever Effect	
		Power		< 200W		Transmission Ratio	
		Long Distance		FALSE		Velocity	
		Continuity		TRUE		Intermittence	
						< 25ms	
						FALSE	