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An active ease-off topography modification approach for hypoid pinions based on a modified error sensitivity analysis method [Texto impreso] / G. Li, W. D. Zhu

Este artículo se encuentra disponible en su edición impresa y electrónica. Los datos para su localización están accesibles a través del enlace al título de la publicación. Su acceso electrónico es a través del enlace de 'Acceso al documento'.

References: p. 093302(12)

A new active ease-off topography modification approach is proposed to improve the meshing performance of hypoid gears based on a fourth-order predesigned transmission error (PTE) model and a modified error sensitivity analysis method. Ease-off topography modifications that describe local deviations of pinion tooth surfaces can be conducted by converting the fourth-order PTE into equivalent deviations of pinion tooth surfaces. The modified error sensitivity analysis method is developed to investigate the effects of misalignments on the moving velocity of a contact point of a hypoid gear pair. The moving velocity of the contact point can describe transmission error (TE) curve shapes of ease-off tooth surfaces. The ease-off topography modification approach can achieve TE precontrol and modification curvature adjustment of the pinion for stable meshing performance of the hypoid gear pair. Moreover, pinion ease-off tooth surfaces are finished by a five-axis computer numerical control swarf-cutting machine tool. Swarf-cutting tests and TE measurement tests are conducted on hypoid gear pair specimens to demonstrate the feasibility and effectiveness of the proposed methodology.

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2

Automatic enumeration of feasible configuration for the dedicated hybrid transmission with multi-degree-of-freedom and multiplanetary gear set [Texto impreso] / Xiangyang Xu, Hanqiao Sun, Yanfang Liu, Peng Dong

Este artículo se encuentra disponible en su edición impresa y electrónica. Los datos para su localización están accesibles a través del enlace al título de la publicación. Su acceso electrónico es a través del enlace de 'Acceso al documento'.

References: p. 093301(14)

This paper presents a novel design approach to systematically synthesize available configurations for dedicated hybrid transmission (DHT) systems subject to design constraints and required operation modes by using simple planetary gear sets (PGSs). The configuration synthesis process includes two main steps. The first step is the synthesis of the PGSs by synthesizing all the components to a simple PGS subject to the design constraints. The second step is to combine the structural and shift elements into all configurations and detect those meeting the requirements with the mechanical and operation mode constraints. By applying the proposed design approach, the configurations of the Toyota's hybrid systems (THSs) and Voltec-II prove the feasibility of the method. Furthermore, several new DHT configurations are synthesized under the new design conditions. The proposed design approach is capable of systematically synthesizing new DHT systems with multiple PGSs, variable design constraints, and expected modes.

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1. Configuration synthesis 2. Dedicated hybrid systems 3. Design approach 4. Planetary gear sets

3

Design of a variable-mobility linkage using the bohemian dome [Texto impreso] / P. C. López-Custodio, J. S. Dai

Este artículo se encuentra disponible en su edición impresa y electrónica. Los datos para su localización están accesibles a través del enlace al título de la publicación. Su acceso electrónico es a través del enlace de 'Acceso al documento'.

References: p. 092303(1-12)

A new method is presented for the design of kinematotropic linkages based on 2-DOF kinematic chains that generate more than one surface. As an example of the proposed method, a kinematotropic linkage is obtained by studying a special case of the Bohemian dome which has two different parametrizations constructed by translation of circles and, therefore, two different hybrid kinematic chains can be designed to generate the same Bohemian dome. Each of these hybrid kinematic chains can generate two different surfaces and, thus, can be used in the

proposed method. Parametrizations for the secondary surfaces are then obtained and studied. A total of 27 motion branches are found in the configuration space of this kinematotropic linkage. The singularities in the configuration space are further determined using the properties of the surfaces. The resultant linkage offers an explanation of Wholhart's queer-square linkage other than its original paper folding. As part of the analysis of this example, the relationship between the properties of self-intersections in generated surfaces and the configuration space of the generator linkage is studied for the first time, leading to a description of motion branches related to self-intersections of generated surfaces.

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An integrated geometric-graph-theoretic approach to representing origami structures and their corresponding truss frameworks [Texto impreso] / Yao Chen ... [et al.]

Este artículo se encuentra disponible en su edición impresa y electrónica. Los datos para su localización están accesibles a través del enlace al título de la publicación. Su acceso electrónico es a través del enlace de 'Acceso al documento'.

References: p. 091402(8)

Origami has provided various interesting applications in science and engineering. Appropriate representations and evaluation on crease patterns play an important role in developing an innovative origami structure with desired characteristics. However, this is generally a challenge encountered by scientists and engineers who introduce origami into various fields. As most practical origami structures contain repeated unit cells, graph products provide a suitable choice for the formation of crease patterns. Here, we will employ undirected and directed graph products as a tool for the representation of crease patterns and their corresponding truss frameworks of origami structures. Given that an origami crease pattern can be considered to be a set of directionless crease lines that satisfy the foldability condition, we demonstrate that the pattern can be exactly expressed by a specific graph product of independent graphs. It turns out that this integrated geometric-graph-theoretic method can be effectively implemented in the formation of different crease patterns and provide suitable numbering of nodes and elements. Furthermore, the presented method is useful for constructing the involved matrices and models of origami structures and thus enhances configuration processing for geometric, kinematic, or mechanical analysis on origami structures.

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Investigating the influence of designers' cognitive characteristics and interaction behaviors in design concept generation [Texto impreso] / Kathryn W. Jablowski ... [et al.]

Este artículo se encuentra disponible en su edición impresa y electrónica. Los datos para su localización están accesibles a través del enlace al título de la publicación. Su acceso electrónico es a través del enlace de 'Acceso al documento'.

References: p. 091101(11-12)

This paper investigates relationships among the cognitive characteristics, interaction behaviors, and ideation outcomes of 14 engineering design teams engaged in concept generation. Cognitive characteristics were measured using the Kirton Adaption-Innovation Inventory (KAI), which assesses an individual's cognitive preference for structure in generating and working with ideas in problem solving. Team interactions were assessed using the Interaction Dynamics Notation (IDN), which allows interaction behaviors to be quantitatively analyzed, while team outcomes were measured in terms of ideation utterances (ideas and unique ideas). Our analyses revealed that cognitive style (KAI) did not correlate significantly with interaction response behaviors (IDN) or with the quantity of ideas/unique ideas produced. However, the cognitive style diversity of the teams did influence the number of topics they discussed, as well as the interconnectedness of those topics. In addition, several specific interaction responses were associated with the occurrence of ideas/unique ideas, although the sequences associated with those responses varied widely; the more adaptive teams also had greater position specificity in these sequences than the more innovative teams. Our findings highlight the importance of forming cognitively diverse design teams and suggest that specific interaction behaviors should be encouraged or taught as a means to increase the occurrence of ideas and/or unique ideas during team concept generation.

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Mining changes in user expectation over time from online reviews [Texto impreso] / Tianjun Hou, Bernard Yannou, Yann Leroy, Emilie Poirson

Este artículo se encuentra disponible en su edición impresa y electrónica. Los datos para su localización están accesibles a través del enlace al título de la publicación. Su acceso electrónico es a través del enlace de 'Acceso al documento'.

References: p. 091102(9-10)

Customers post online reviews at any time. With the timestamp of online reviews, they can be regarded as a flow of information. With this characteristic, designers can capture the changes in customer feedback to help set up product improvement strategies. Here, we propose an approach for capturing changes in user expectation on product affordances based on the online reviews for two generations of products. First, the approach uses a rule-based natural language processing method to automatically identify and structure product affordances from review text. Then, inspired by the Kano model which classifies preferences of product attributes in five categories, conjoint analysis is used to quantitatively categorize the structured affordances. Finally, changes in user expectation can be found by applying the conjoint analysis on the online reviews posted for two successive generations of products. A case study based on the online reviews of Kindle e-readers downloaded from amazon.com shows that designers can use our proposed approach to evaluate their product improvement strategies for previous products and develop new product improvement strategies for future products

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Multidisciplinary design of electric vehicles based on hierarchical multi-objective optimization [Texto impreso] / Kesavan Ramakrishnan , Gianpiero Mastinu , Massimiliano Gobbi

Este artículo se encuentra disponible en su edición impresa y electrónica. Los datos para su localización están accesibles a través del enlace al título de la publicación. Su acceso electrónico es a través del enlace de 'Acceso al documento'.

References: p. 091404(10)

A method for the optimal design of complex systems is developed by effectively combining multi-objective optimization and analytical target cascading techniques. The complex systems with high dimensionality are partitioned into manageable subsystems that can be optimized using dedicated algorithms. The multiple objective functions in each subsystem are treated simultaneously, and the interactions between subsystems are managed using linking variables and shared variables. The analytical target cascading algorithm ensures the convergence of the optimal solution that meets the system level targets while complying with the subsystem level constraints. A design optimization of electric vehicles with in-wheel motors is formulated as a two-level hierarchical scheme where the top level has a model representing the electric vehicle and the bottom level contains models of battery and suspension. The vehicle model includes an electric motor model and a power electronics model. Pareto-optimal solutions are derived holistically. The effectiveness of the proposed method for optimizing the complex systems is compared against the conventional all-in-one optimization approach.

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8

Multiple Target Exploration Approach for Design Exploration Using a Swarm Intelligence and Clustering [Texto impreso] / Hyeongmin Han, Sehyun Chang, Harrison Kim

Este artículo se encuentra disponible en su edición impresa y electrónica. Los datos para su localización están accesibles a través del enlace al título de la publicación. Su acceso electrónico es a través del enlace de 'Acceso al documento'.

References: p. 091401(9)

In engineering design problems, performance functions evaluate the quality of designs. Among the designs, some of them are classified as good designs if responses from performance functions satisfy a target point or range. An infinite set of good designs in the design space is defined as a solution space of the design problem. In practice, since the performance functions are analytical models or black-box simulations which are computationally expensive, it is difficult to obtain a complete solution space. In this paper, a method that finds a finite set of good designs, which is included in a solution space, is proposed. The method formulates the problem as optimization

problems and utilizes gray wolf optimizer (GWO) in the way of design exploration. Target points of the exploration process are defined by clustering intermediate solutions for every iteration. The method is tested with a simple two-dimensional problem and an automotive vehicle design problem to validate and check the quality of solution points.

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Novel gear transmission mechanism with twice unequal amplitude transmission ratio [Texto impreso] / Gaohong Yu ... [et al.]

Este artículo se encuentra disponible en su edición impresa y electrónica. Los datos para su localización están accesibles a través del enlace al título de la publicación. Su acceso electrónico es a través del enlace de 'Acceso al documento'.

References: p. 092304(8-9)

The operation effectiveness of multi-bar transplanting mechanisms is low, and the specific changing law of the transmission ratio (the curve of the transmission ratio has twice unequal amplitude [TUA] fluctuation.), which is needed in vegetable pot seedling transplanting, is difficult to fulfill using a planetary gear train with noncircular gears and a single-planet carrier. To address this problem, we propose a noncircular gear pair that comprises an incomplete noncircular gear, rack, partial noncircular gear, and elliptical gear. The structural characteristics and the working principle of the TUA gear pair were analyzed. The pitch curve equation of the noncircular TUA gears was derived from the relationship of the angular displacement of the corresponding pitch curves. The influence of central angle α and eccentricity k on the shape of the pitch curve, angular displacement, and transmission ratio of the TUA gear pair was analyzed. The TUA gear pair was applied to a proposed vegetable seedling pickup mechanism (SPM) considering the design requirements. Finally, the feasibility of the new noncircular TUA gear transmission mechanism was verified by an SPM test.

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1. Elliptical gear 2. Incomplete noncircular gear 3. Planetary gear train 4. Transplanting mechanism

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Stiffness design of circular-axis hinge, self-similar mechanism with large out-of-plane motion [Texto impreso] / N. Lobontiu, T. Gress, M. Gh. Munteanu, B. Ilic

Este artículo se encuentra disponible en su edición impresa y electrónica. Los datos para su localización están accesibles a través del enlace al título de la publicación. Su acceso electrónico es a través del enlace de 'Acceso al documento'.

References: p. 092302(9)

This research proposes the self-similarity design concept of flexible mechanisms by studying the out-of-plane, piston motion of a compliant device. Self-similar compliant mechanisms can be formed by connecting flexible units of scaled-down, identical geometry in series and/or parallel. We study a folded-architecture, compact mechanism class formed of multiple flexible, circular, and concentric segments that are serially connected. The device is capable of producing large displacements by summing the small deformations of its units. A simple analytical model is derived, which predicts the mechanism piston compliance/stiffness in terms of configuration, geometry, and material parameters. Experimental testing of a prototype and finite element simulation of various designs confirm the validity of the mathematical model. Several particular designs resulting from the generic architecture are further characterized based on the analytical model to highlight the mechanism stiffness performance and the way it scales with its defining parameters and unit stiffness.

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1. Compliance 2. Design 3. Flexible 4. Flexure hinge 5. Fractal 6. Large displacements 7. Mathematical model 8. Mechanism 9. Out-of-plane 10. Self-similarity 11. Small deformations 12. Stiffness

11

Time-dependent concurrent reliability-based design optimization integrating the time-variant B-distance index [Texto impreso] / Zhonglai Wang, Zhihua Wang, Shui Yu, Xiaowen Cheng

Este artículo se encuentra disponible en su edición impresa y electrónica. Los datos para su localización están accesibles a través del enlace al título de la publicación. Su acceso electrónico es a través del enlace de 'Acceso al documento'.

References: p. 091403(7-8)

This paper presents a time-dependent concurrent reliability-based design optimization (TDC-RBDO) method integrating the time-variant B-distance index to improve the confidence level of design results with a small amount of experimental data. The time-variant B-distance index is first constructed using the extreme values of responses. The Hist Loop CDF (HLCDF) algorithm is then presented to calculate the time-variant B-distance index with high computational efficiency. The TDC-RBDO framework is provided by integrating the time-variant B-distance index and time-dependent reliability. The extreme value moment method (EVMM) is implemented to speed up the procedure of the TDC-RBDO. The case of a harmonic reducer is employed to elaborate on the proposed method.

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Topological characterization of an evolving product structure network [Texto impreso] : a case study of generational smartphone products / Kijung Park, Gül E. Okudan Kremer

Este artículo se encuentra disponible en su edición impresa y electrónica. Los datos para su localización están accesibles a través del enlace al título de la publicación. Su acceso electrónico es a través del enlace de 'Acceso al documento'.

References: p. 091103(10-11)

Products evolve over time to satisfy new customer needs, technologies, and markets. The evolution process of products necessarily involves changes in a product structure that might be characterized by inherent evolving properties. Although product evolution has been discussed from various perspectives, the underlying properties of an evolving product structure have not been sufficiently explored from an analytical view. Various empirical and theoretical studies in network science show that real networks representing different types of complex systems are not randomly structured but are characterized by certain properties regardless of their origins. Focusing on the topological universality of real networks, this study aims to reveal the inherent evolving properties of a product structure based on a network science approach through a case study of generational smartphone models. First, the product structure of each generational product is represented as a product structure network. Then, topological characteristics and patterns in each network are analyzed by network measures and motifs. The results show that the product structure networks may follow the universal properties observed in other real networks; the product structure grows as a scale-free network with common building blocks. The findings from this study suggest that the identified properties can be used as a basis to understand and formulate product evolution to obtain design benefits from topological robustness and modularity.

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A transformation method to generate the workspace of an n(3RRS) serial-parallel manipulator [Texto impreso] / Hongwei Guo ... [et al.]

Este artículo se encuentra disponible en su edición impresa y electrónica. Los datos para su localización están accesibles a través del enlace al título de la publicación. Su acceso electrónico es a través del enlace de 'Acceso al documento'.

References: p. 092301(9)

This paper presents a transformation method to generate the workspace of an n(3RRS) serial-parallel manipulator (S-PM). Firstly, the boundary of the workspace of the 3RRS parallel manipulator (PM) is obtained using the boundary search method and verified by MATLAB/SimMechanics simulation. Secondly, the workspace of the 2(3RRS) S-PM is obtained using the proposed method and verified by MATLAB/SimMechanics simulation. Finally, the workspace of the 3(3RRS) S-PM is obtained using the proposed method. The results indicate that the n(3RRS) S-PM can significantly expand its workspace with the increase in the number of PMs connected in series, and the proposed method can generate the workspaces of n(3RRS) S-PMs efficiently with the advantages of simple operation, high efficiency, and high accuracy. The proposed method is applicable to all S-PMs that are composed of PMs, and it provides a reference for solving the workspaces of other types of redundantly hybrid manipulators.

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Unilateral manipulability quality indices [Texto impreso] : generalized manipulability measures for unilaterally actuated robots / Jonathan Eden, Darwin Lau, Ying Tan, Denny Oetomo

Este artículo se encuentra disponible en su edición impresa y electrónica. Los datos para su localización están accesibles a través del enlace al título de la publicación. Su acceso electrónico es a través del enlace de 'Acceso al documento'.

References: p. 092305(11)

The study of the relationship between the desired system dynamics and the actuation wrench producing those dynamics is important for robotic system analysis. For traditionally actuated robots, the quality indices of dexterity and manipulability quantify this relationship. However, for unilaterally actuated robots (UARs), such as grasping hands and cable-driven parallel robots (CDPRs), these indices cannot be applied due to the unilateral actuation constraint. In this paper, the quality indices of unilateral dexterity (UD) and unilateral maximum force amplification (UMFA) are established for UARs with arbitrary number of actuators. It is shown that these quality indices provide task-independent quantifications of the physical properties of robustness and force amplification for UARs, and they can measure the mechanism's capability both in singular and nonsingular poses. With these indices, manipulability ellipsoid-derived measures can be applied to arbitrary UARs. The significance of the quality indices for robot synthesis and motion generation analysis is illustrated through two case studies: a five-fingered grasp selection problem and the workspace analysis of a spatial CDPR.

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