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A comparison of the tolerance analysis methods in the open-loop assembly

Kosec, P.[a], **Škec, S.**[a,b,*], **Miler, D.**[a]

[a]University of Zagreb, Faculty of Mechanical Engineering and Naval Architecture, Zagreb, Croatia
[b]Technical University of Denmark, Kongens Lyngby, Denmark

ABSTRACT

Dimensional and geometric tolerances affect both the cost and the functionality of a given product. Finding the acceptable trade-off between the two is among the common engineering tasks. Thus, many tolerance analysis methods are developed to help engineers and assist in the decision-making process. In this article, the authors have assessed four tolerance analysis methods by applying them to the open-loop assembly. The results obtained by the tolerance chart (worst-case) method, Monte-Carlo simulation, vector-loop analysis, and the Unified Jacobian-torsor model were analysed and compared. Additionally, the overview and application guidelines are included for each of the methods, aiming to help both researchers and practitioners. The results have confirmed that there are significant variations in the outputs across the observed methods, implying the need for informed method selection.

ARTICLE INFO

Keywords:
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Computer aided tolerancing;
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**Corresponding author:*
stanko.skec@fsb.hr
(Škec, S.)

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Izvirni znanstveni članek

Primerjava metod tolerančne analize v sestavu z odprto zanko

Kosec, P.[a], **Škec, S.**[a,b,*], **Miler, D.**[a]

[a]University of Zagreb, Faculty of Mechanical Engineering and Naval Architecture, Zagreb, Croatia
[b]Technical University of Denmark, Kongens Lyngby, Denmark

POVZETEK

Dimenzijske in geometrijske tolerance vplivajo tako na stroške kot na funkcionalnost določenega izdelka. Iskanje sprejemljivega kompromisa med obema je ena izmed pogostih inženirskih nalog. Razvitih je veliko metod analize tolerance, ki pomagajo inženirjem pri odločanju. V tem članku so avtorji ocenili štiri metode analize tolerance, tako da so jih uporabili na sestavu z odprto zanko. Analizirani in primerjani so bili rezultati, pridobljeni z metodo tolerančnega diagrama (najslabši primer), Monte-Carlo simulacijo, vektorsko zančno analizo in poenotenim Jakobi-torzorskim modelom. Poleg tega so za vsako od metod vključeni pregled in smernice za uporabo, katerih namen je pomagati raziskovalcem in izvajalcem. Rezultati so potrdili, da obstajajo znatne razlike v učinkih opazovanih metod, kar kaže na potrebo po informirani izbiri metode.

PODATKI O ČLANKU

Ključne besede:
Sestav;
Sestav z odprto zanko;
Analiza tolerance;
Računalniško podprte tolerance;
Analiza diagrama toleranc;
Enotni Jakobi-torzorski model;
Metoda Monte Carlo;
Analiza vektorske zanke

**Kontaktna oseba:*
stanko.skec@fsb.hr
(Škec, S.)

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