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Using a discrete event simulation as an effective method applied in the production of recycled material

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ABSTRACT

Technological processes play an essential task in the enterprise's production system. The behaviour and functioning of these systems cannot be predicted with certainty as they belong to a group of probable determinate structures. Generally, if we wanted to know precisely the behaviour of this condition in advance, we would have to be able to describe them mathematically or observe the action of the system on a real object. By applying discrete event simulation software, we realize the development of environmentally friendly products and using the simulation, we gain the certainty that the planned tasks can be implemented in a given time frame, while the simulation of the production process can help to clearly clarify and better understand the processes. To choose the optimal manufacturing ways of cleaning the fabrics component from waste tyres, we used the Witness discrete event simulation software to determine the usability and time occupancy of individual machines in the production of new fabric-based material. We simulated the ultrasonic method of cleaning the fabrics component from waste tyres and the subsequent creation of the test specimen. After the simulation, the obtained data can be used by a selection of type and number of machines and auxiliary equipment, by numbers of tools and fixtures, and by numbers of transport equipment. Obtained results bring the best layout of the workplace, the optimal dose of input materials and resources used in production. We have identified bottlenecks in the machines with long waiting times. The research priority was to reduce bottlenecks and increase the effectiveness of the entire of production line.

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Waste tyres;
Discrete event simulation;
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Izvirni znanstveni članek

Uporaba simulacije diskretnih dogodkov kot učinkovite metode v proizvodnji recikliranega materiala

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POVZETEK

Tehnološki procesi imajo bistveno vlogo v proizvodnem sistemu podjetja. Obnašanja in delovanja proizvodnega sistema podjetja pa ni mogoče z gotovostjo napovedati, saj gre za strukture, ki so podrejene verjetnosti. Če bi želeli napovedati obnašanje nekega sistema v realnem okolju, bi morali skrbno opazovati njegovo delovanje in ga matematično natančno opisati. Z uporabo programske opreme za simulacijo diskretnih dogodkov lahko pripomoremo k boljšemu razumevanju proizvodnega procesa, ugotovimo, ali je načrtovane naloge mogoče izvesti v določenem časovnem okviru ter uresničujemo razvoj okolju prijaznih izdelkov. V tej raziskavi smo za proizvodni proces odstranjevanja tkanine iz odpadnih pnevmatik uporabili programsko opremo za simulacijo diskretnih dogodkov Witness, s pomočjo katere smo ugotovili uporabnost in časovno zasedenost posameznih strojev pri proizvodnji novega materiala na osnovi reciklirane tkanine. Simulirali smo ultrazvočno metodo odstranjevanja tkanine iz odpadnih pnevmatik in kasnejšo izdelavo testnega vzorca. Po simulaciji smo pridobljene podatke uporabili za izbiro vrste in števila strojev, pomožne opreme, kot so orodja in vpenjalne naprave ter števila transportnih naprav in določili najboljšo ureditev delovnega mesta ter optimalno količno vhodnih materialov in virov. Na nekaterih strojih smo prepoznali in zmanjšali ozka grla z dolgimi čakalnimi dobami in povečali učinkovitost celotne proizvodne linije.

PODATKI O ČLANKU

Ključne besede:
Zelena proizvodnja;
Recikliranje;
Odpadne pnevmatike;
Simulacija diskretnih dogodkov;
Programska oprema Witness;
Gospodarski učinek;
Učinkovitost;
Ultrazvočno ločevanje

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