Technická univerzita v Košiciach
Fakulta baníctva, ekológie, riadenia a geotechnológií

Elaborát z predmetu Matematické metódy identifikácie, modelovania a simulácie

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Obsah

1 Introduction

The objective of process control is to keep key process-operating parameters within narrow bounds of the reference value or setpoint. Controllers are used to automate a human function in an effort to control a variable. A basic controller can keep an individual loop on an even point, so long as there is not too much disruption. Complex processes like ones in metallurgy might employ dozens or even hundreds of such controllers, but keeping an eye on the big picture was, until not so long ago, a human process Al-Megren and Ruddle (2016).

Cieľom riadenia procesu je udržiavať kľúčové parametre prevádzky procesu v úzkom rozmedzí referenčnej hodnoty alebo požadovanej hodnoty. Ovládače sa používajú na automatizáciu ľudskej funkcie v snahe ovládať premennú. Základný ovládač môže udržiavať jednotlivú slučku na rovnomernom mieste, pokiaľ nedôjde k prílišnému prerušeniu. Komplexné procesy, ako sú procesy v metalurgii, môžu zamestnávať desiatky alebo dokonca stovky takýchto regulátorov, ale pozor na celkový obraz bol až donedávna ľudským procesom Al-Megren and Ruddle (2016)

Although a device was used to automate a human function in an effort to control a variable, there was no sense of what the process was doing overall. A basic controller could keep an individual loop on an even keel, more or less, so long as there was not too much disruption. Complex processes might employ dozens or even hundreds of such controllers, each with its performance displayed on a panel board, but keeping an eye on the big picture was still a human process.

Aj keď sa zariadenie používalo na automatizáciu ľudskej funkcie v snahe ovládať premennú, nemal zmysel, čo tento proces celkovo robí. Základný ovládač by mohol udržiavať individuálnu slučku na rovnomernom kýli viac alebo menej, pokiaľ nenastane príliš veľa prerušenia. Komplexné procesy môžu využívať desiatky alebo dokonca stovky takýchto kontrolérov, z ktorých každý má svoj výkon zobrazený na doske, ale pozor na celkový obraz bol stále ľudský proces.

The need for developing improved control systems has traditionally been powered by the demand for more accurate and cost efficient production. This is still a major driving force but environmental issues do also have a profound influence on this development today (Widlund et al. (1998)).

Potreba vývoja zdokonalených systémov riadenia bola tradične poháňaná požiadavkou presnejšej a nákladovo efektívnejšej výroby. Je to stále hlavná hnacia sila, ale environmentálne otázky majú na tento vývoj zásadný vplyv aj dnes (Widlund et al. (1998)).

The main objective of controlling oxygen converter steelmaking is to obtain prescribed parameters for the steel when it is tapped from the furnace, including weight, temperature, and each element content. In practical steelmaking process, the criterion whether the molten steel is acceptable or not is often decided by the endpoint carbon content and temperature (Wang et al. (2010)).

Hlavným cieľom riadenia výroby ocele s kyslíkovým konvertorom je získanie predpísaných parametrov pre oceľ, keď sa odoberá z pece, vrátane hmotnosti, teploty a obsahu každého prvku. V praktickom procese výroby ocele sa o konečnom obsahu uhlíka a teplote často rozhoduje o tom, či je roztavená oceľ prijateľná alebo nie Wang et al. (2010).

Generally, the LD/BOF steelmaking process with sub-lance system can be divided into two stages: static control and dynamic control. Static models include oxygen supplying model, slaging model and bottom blowing model; dynamic models include decarburization speed model, molten steel warming model and the model for the amount of coolant. (Wang et al. (2010)).

The fast dynamics of the LD converter steelmaking process or the BOF process, as it is commonly known, often makes it a challenge to obtain stable blowing conditions and to achieve the required steel composition and temperature simultaneously at the end point. For this reason, process control becomes very necessary and attempts had started as early as in the 1970s (Fritz and Gebert (2005)). Out of the originally very simple LD process have grown the modern process-controlled and automated production systems that enable present-day adaptations to meet today's economic and ecological demands (Sarkar et al. (2015)). The non-linear nature of chemical and thermodynamical processes in basic oxygen steelmaking also amassed interest in developing new mathematical models based on fractionalorder calculus.

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