Title (en)

Regulation method for the casting mirror of a continuous casting mould

Title (de)

Regelverfahren für den Gießspiegel einer Stranggießkokille

Title (fr)

Procédé de réglage pour la surface de bain d'une coquille de coulée par faisceau

Publication

EP 2272605 A1 20110112 (DE)

Application

EP 09163538 A 20090624

Priority

EP 09163538 A 20090624

Abstract (en)

The control method for the meniscus of a continuous casting mold, comprises adjusting the inflow of liquid metal into a continuous casting mold by a closure device and withdrawing the partially solidified metal strand from the continuous casting mold by a withdrawal device. A measured actual value of the meniscus is fed to a meniscus controller, which determines a target position for the closure device on the basis of the actual value and a corresponding target value. The measured actual value is fed to a disturbance variable compensator. The control method for the meniscus of a continuous casting mold, comprises adjusting the inflow of liquid metal into a continuous casting mold by a closure device and withdrawing the partially solidified metal strand from the continuous casting mold by a withdrawal device. A measured actual value of the meniscus is fed to a meniscus controller, which determines a target position for the closure device on the basis of the actual value and a corresponding target value. The measured actual value is fed to a disturbance variable compensator. The target position for the closure device, or a target position corrected by a disturbance variable compensation value, or a corresponding actual value are further fed to the disturbance variable compensator. The disturbance variable compensator determines the disturbance variable compensation value. The corrected target position is fed to the closure device. The disturbance variable compensator comprises a model (21) of the continuous casting mold by means of which it determines an expected value for the meniscus on the basis of a model input value. The disturbance variable compensator further comprises a number of oscillating compensators (23) by means of which a frequency disturbance proportion is determined on the basis of the difference between the actual value und the expected value, each relative to a related disturbance frequency. The sum of the frequency disturbance proportions corresponds to the disturbance variable compensation value. The model input value is determined by the relation of i=p'+z1, where p' is the uncorrected target or actual position of the closure device and z' is a jump compensation value. The disturbance variable compensator comprises a jump determiner (22), by means of which it determines the jump compensation value by integrating the difference. The model of the continuous casting mold consists of a series connection of model integrator with a model delay element (26), where each oscillating compensator exists out of a series connection of two oscillating integrators and the jump determiner exists out of an individual jump integrator. The model integrator has a value of m=Vi+h1e, the model delay element has a value of m'=1+h2e, the front oscillation generator has oscillation compensator with a value of s1=h3e-S2, the back oscillation generator has oscillation compensator with a value of s2=h4e+S1 and the jump integrator has a value of s3=h5e, where V is amplification factor, i is model input value, e is the difference of actual value and expected value, I is the exit signal of the model integrator, SI is the exit signal of the respective front oscillation integrator, S2 is the exit signal of the respective back oscillation integrator, h1 and h2 are model adaptation factors, h3 and h4 are oscillation adaptation factors specified for the respective oscillation compensator and h5 is jump adaptation factor. The adaptation factors are determined in such a way that the pole of the transmission function determined through the model of the continuous casting mold fulfills the conditions such as interfering frequency arises a pair of conjugated complex, whose real parts are smaller than zero and whose imaginary parts are equal to a circular frequency defined through the respective interfering frequency so that it arises three poles that are all smaller than zero. The adaptation factors are determined in such a way that the real part of the conjugated complex pole is -0.3 to -0.1 related to the respective circular frequency. The adaptation factors are determined in such a way that the poles are smaller than -2.0 and are different in pairs from one another. The adaptation factors are determined in such a way that one of the real poles is -4.5 to -5.5. The number of oscillation compensators is greater than one. Independent claims are included for: (1) a computer program; and (2) a control device for continuous casting mold.

Abstract (de)

Der Zufluss flüssigen Metalls (3) in eine Stranggießkokille (1) wird mittels einer Verschlusseinrichtung (4) eingestellt. Mittels einer Abzugseinrichtung (8) wird der teilerstarrte Metallstrang (7) aus der Stranggießkokille (1) abgezogen. Ein gemessener Istwert (hG) des Gießspiegels (9) wird einem Gießspiegelregler (18) zugeführt, der anhand des Istwerts (hG) und eines korrespondierenden Sollwerts (hG*) eine Sollstellung (p*) für die Verschlusseinrichtung (4) ermittelt. Der gemessene Istwert (hG) wird einem Störgrößenkompensator (20) zugeführt. Dem Störgrößenkompensator (20) wird weiterhin die Sollstellung (p*) für die Verschlusseinrichtung (4) oder eine um einen Störgrößenkompensationswert (z) korrigierte Sollstellung oder ein entsprechender Istwert (p) zugeführt. Der Störgrößenkompensator (20) ermittelt den Störgrößenkompensationswert (z). Der Verschlusseinrichtung (4) wird die korrigierte Sollstellung zugeführt. Der Störgrößenkompensator (20) umfasst ein Modell (21) der Stranggießkokille (1), mittels dessen er anhand eines Modelleingangswertes (i) einen Erwartungswert (hE) für den Gießspiegel (9) ermittelt. Der Störgrößenkompensator (20) umfasst weiterhin eine Anzahl von Schwingungskompensatoren (23), mittels derer er anhand der Differenz (e) von Istwert (hG) und Erwartungswert (hE) jeweils einen auf eine jeweilige Störfrequenz (fS) bezogenen Frequenzstöranteil (zS) ermittelt. Die Summe der Frequenzstöranteile (zS) entspricht dem Störgrößenkompensationswert (z). Der Modelleingangswert (i) ist durch die Beziehung i = p'+z' bestimmt, wobei p' die unkorrigierte Soll- oder Iststellung (p*, p) der Verschlusseinrichtung (4) und z' ein Sprungkompensationswert sind. Der Störgrößenkompensator (20) umfasst einen Sprungermittler (22), mittels dessen er anhand der Differenz (e) den Sprungkompensationswert (z') ermittelt.

IPC 8 full level

B22D 11/16 (2006.01); **B22D 11/18** (2006.01)

CPC (source: EP US)

B22D 11/16 (2013.01 - EP US); **B22D 11/181** (2013.01 - EP US)

Citation (applicant)

- US 5921313 A 19990713 - NIEMANN MARTIN [DE], et al
- VON C. FURTMUELLER; E. GRUENBACHER: "Suppression of Periodic Disturbances in Continuous Casting using an Internal Model Predictor", IEEE INTERNATIONAL CONFERENCE ON CONTROL APPLICATIONS, 4 October 2006 (2006-10-04), pages 1764 - 1769

Citation (search report)

[A] DE 19640806 A1 19980409 - SIEMENS AG [DE]

Designated contracting state (EPC)

AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO SE SI SK TR

DOCDB simple family (publication)

EP 2272605 A1 20110112; BR PI1013800 A2 20160412; BR PI1013800 B1 20181113; CN 102458718 A 20120516; CN 102458718 B 20160907; EP 2445667 A1 20120502; EP 2445667 B1 20190220; RU 2012102263 A 20130727; RU 2506141 C2 20140210; US 2012101625 A1 20120426; US 8788084 B2 20140722; WO 2010149419 A1 20101229

DOCDB simple family (application)

EP 09163538 A 20090624; BR PI1013800 A 20100506; CN 201080028283 A 20100506; EP 10717648 A 20100506; EP 2010056151 W 20100506; RU 2012102263 A 20100506; US 201013380686 A 20100506