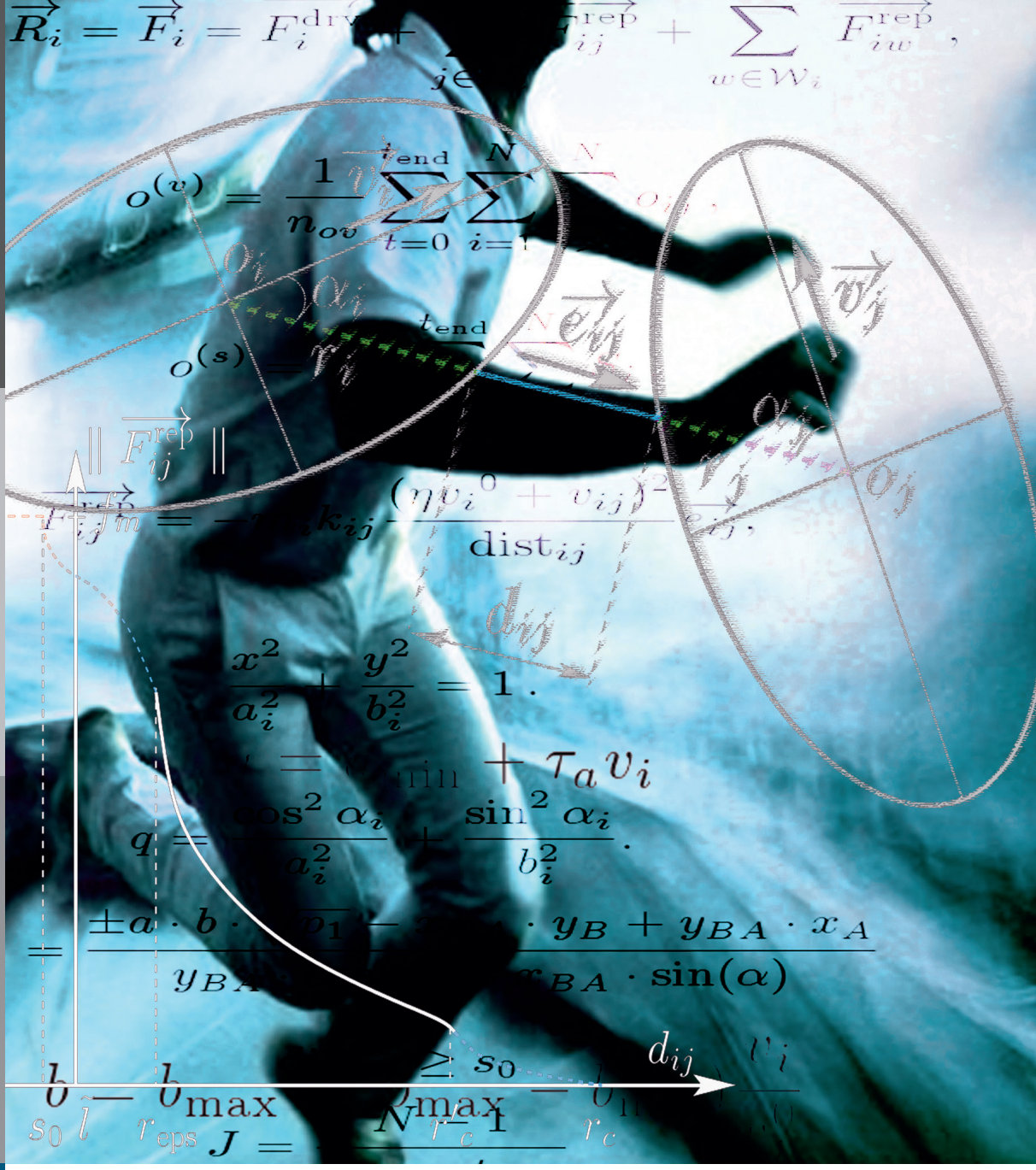

Validated force-based modeling of pedestrian dynamics

Mohcine Chraibi

Mitglied der Helmholtz-Gemeinschaft

JÜLICH
FORSCHUNGSZENTRUM

Forschungszentrum Jülich GmbH
Institute for Advanced Simulation (IAS)
Jülich Supercomputing Centre (JSC)

Validated force-based modeling of pedestrian dynamics

Mohcine Chraibi

Schriften des Forschungszentrums Jülich
IAS Series Volume 13

ISSN 1868-8489 ISBN 978-3-89336-799-3

TABLE OF CONTENTS

This publication was written at the Jülich Supercomputing Centre (JSC) which is an integral part of the Institute for Advanced Simulation (IAS). The IAS combines the Jülich simulation sciences and the supercomputer facility in one organizational unit. It includes those parts of the scientific institutes at Forschungszentrum Jülich which use simulation on supercomputers as their main research methodology.

This dissertation investigates force-based modeling of pedestrian dynamics. Having the quantitative validation of mathematical models in focus principle questions will be addressed throughout this work: Is it manageable to describe pedestrian dynamics solely with the equations of motion derived from the Newtonian dynamics?

On the road to giving answers to this question we investigate the consequences and side-effects of completing a force-based model with additional rules and imposing restrictions on the state variables.

Another important issue is the representation of modeled pedestrians. Does the geometrical shape of a two dimensional projection of the human body matter when modeling pedestrian movement? If yes which form is most suitable? This point is investigated in the second part while introducing a new force-based model.

Moreover, we highlight a frequently underestimated aspect in force-based modeling which is to what extent the steering of pedestrians influences their dynamics? In the third part we introduce four possible strategies to define the desired direction of each pedestrian when moving in a facility.

Finally, the effects of the aforementioned approaches are discussed by means of numerical tests in different geometries with one set of model parameters. Furthermore, the validation of the developed model is questioned by comparing simulation results with empirical data.

IAS Series
Volume 13
ISBN 978-3-89336-799-3

JÜLICH
FORSCHUNGSZENTRUM