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Bachelor's Thesis

Concept and development of a parameterized human robot interface using Augmented Reality

Konzept und Entwicklung einer parametrisierten Mensch-Maschine Schnittstelle mit Augmented Reality (GERMAN)

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Abstract

This bachelor's thesis proposes means to shift the development weight from programming over to parameterisation. This trend is also seen in the robotics community in general and might allow little-trained personal to actively contribute in development teams without much training time.

Kurzzusammenfassung

Table of Contents

List of Figures

List of Tables

Nomenclature

Abbreviations

Abbreviation	Description
ATR	Autothermal reforming
GTL	Gas-to-liquids
PFR	Plug flow reactor
SBCR	Slurry bubble column reactor
WGS	Water-gas shift reaction

Latin Symbols

Symbol	Description	Unit
$H_{i,j}$	Henry constant of species i in j	Pa
$RMSD$	Root-mean-square deviation	depends
RSS	Residual sum of squares	depends
t	Time	s
T	Temperature	K
V	Volume	m^3
$\dot{V}$	Volumetric flow rate	m^3/s
x	Molar fraction in liquid phase	–
z	Axial reactor coordinate	m

Greek Symbols

Symbol	Description	Unit
η	Dynamic viscosity	Pa s
ρ	Density	kg/m^3
τ_{Rel}	Residence time	–
ω_i	Weight fraction	–

Subscripts

Symbol	Description
0	Initial
i	Fraction, index, species
j	Index, species
L	Liquid
ref	Reference
S	Solid

Superscripts

Symbol	Description
j	Cell index

Dimensionless groups

Definition	**Name**
$Bo = \frac{vL}{D_{eff,i}}$	Bodenstein number
$d^* = d\left(\frac{\rho g \Delta\rho}{\eta^2}\right)^{1/3}$	Dimensionless particle diameter
$K_C = \frac{\rho\sigma^3}{g\eta^4}$	Modified Morton number
$Mo = \frac{g\eta^4\Delta\rho}{\rho^2\sigma^3}$	Morton number
$Re = \frac{\rho d v}{\eta}$	Reynolds number
$Sc = \frac{\eta}{\rho D_{i,j}}$	Schmidt number
$v_0^* = v_0\left(\frac{\rho^2}{\eta g \Delta\rho}\right)^{1/3}$	Dimensionless velocity

1 Introduction

Augmented Reality (AR) can help us to communicate with robots in three dimensions. With rapid advancements in the field of robotics during the last few years [1], innovative ways to program, develop and operate these highly complex systems need to be researched. Both robotics and AR have been heavily worked on for the last 20 years, but their combination has mostly remained untouched. Lately though, it has become a new focus area in research.

According to the U.S. Department of Labour, there is a massive hunt for talent in the software industry [2]. The department reported an expected growth of over 30% within the next 10 years. One possible reason could be, that acquiring the necessary skills to develop software applications takes a long time and is not viewed as an easy path. Specifically AR applications currently require a wide variety of skills. On top of that, many processes and steps have to be repeated for each new AR-application and it is increasingly hard to build upon other peoples work.

The lack of programming talent is also seen in the robotics industry, which requires its developers to posses an even wider set of skills, including software development, mechanical and the basics of electrical engineering. Due to the lack of developers the speed of innovation and time-to-market is slowed as stated by multiple companies worldwide.

1.1 Introduction to Augmented Reality

1 Bibliography

[1] C. Laschi, B. Mazzolai, and M. Cianchetti, "Soft robotics: Technologies and systems pushing the boundaries of robot abilities", *Sci. Robot.*, vol. 1, no. 1, eaah3690, 2016.

[2] U. D. o. L. Bureau of Labor Statistics. (2018). Occupational outlook handbook, software developers, [Online]. Available: `https://www.bls.gov/ooh/computer-and-information-technology/software-developers.htm` (visited on 03/28/2019).