Wheelchair Climbing Construction for Industrial Logistical Applications

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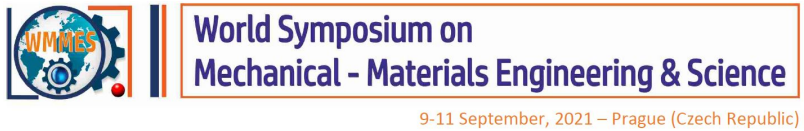

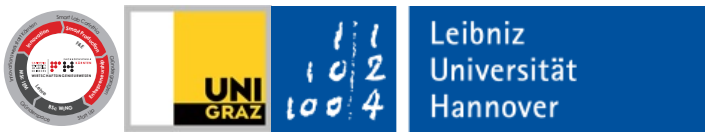

Content

Introduction

Introduction

Motivation and Introduction:

- Human and Machines Interaction↑
- Stair Climbing not well solved in Society & Industry
- Logistics↑

Method and Goal:

- Investigate Systemic Novelties of Stair Climbing Wheelchair Patent 'Malteserrollstuhl' (Malteser-wheelchair)

Wheelchair Climbing Construction

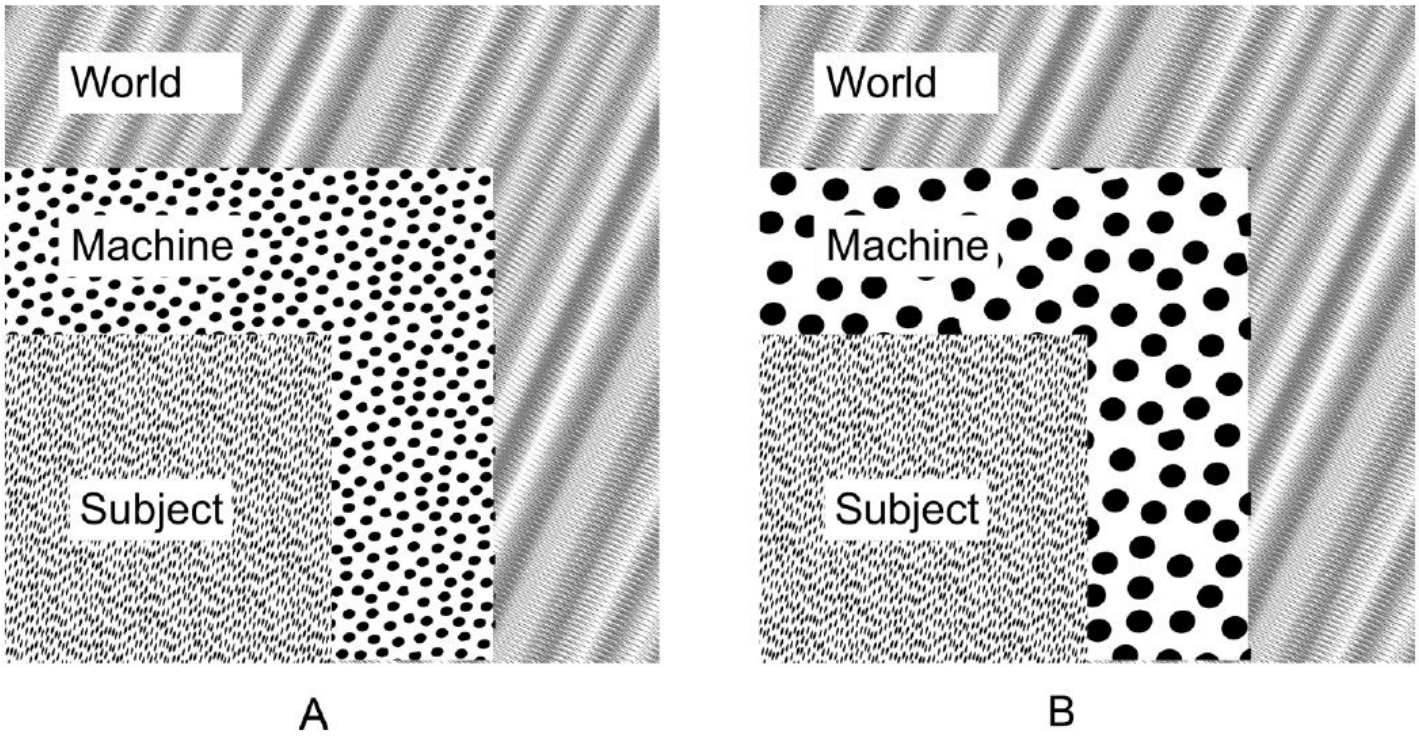

Figure 1: The all-around point of view (AAVP) with views A and B. The world is transparent for a subject using a machine, means, application.

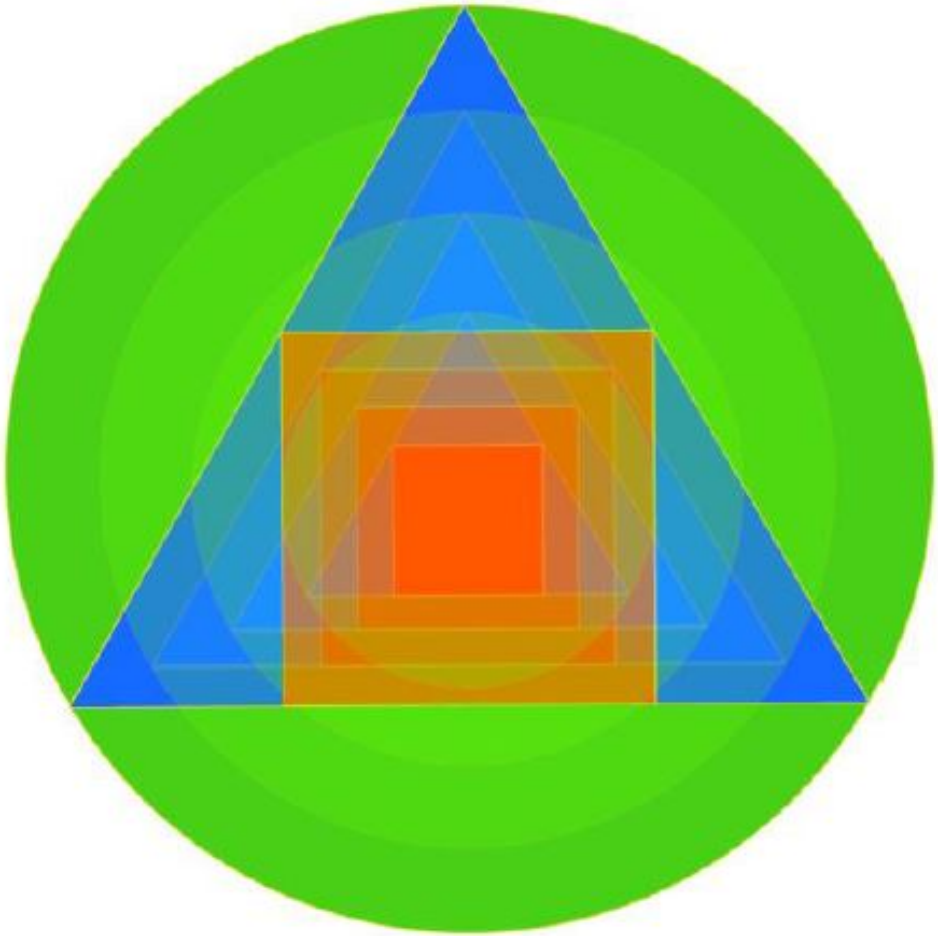

Figure 2: Transparent orgiton model → order structures are visible.

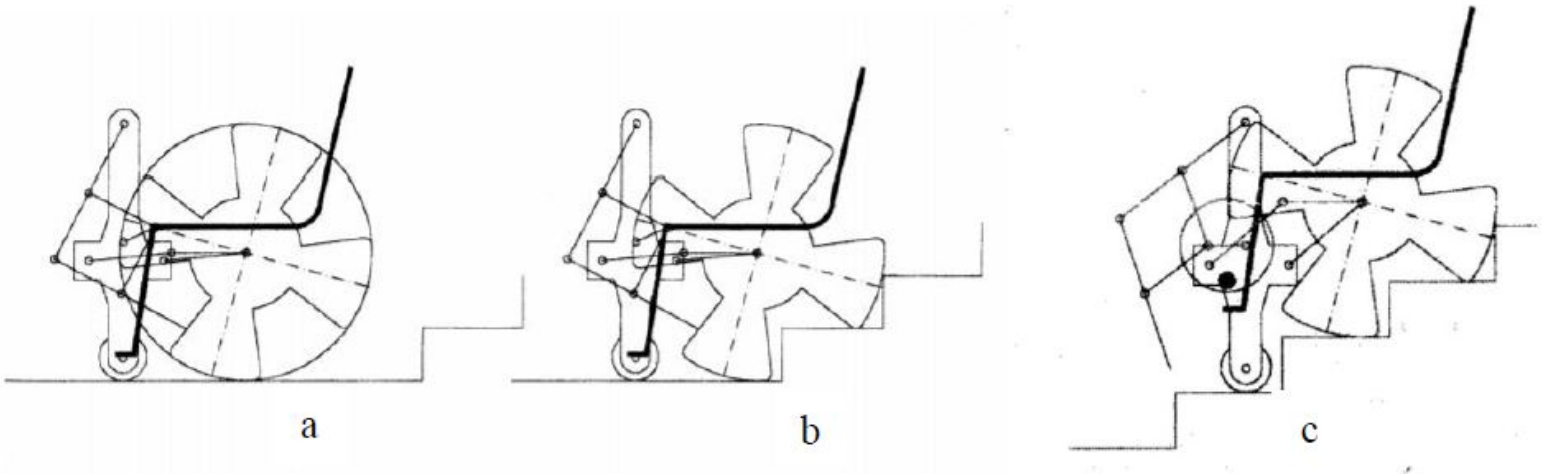

Figure 3: Malteserrollstuhl in its first version according to [10]. In (a) the unfolded Malteserrad (Malteser-wheel) for the use in the plane is shown. In (b, c) the Malteserrollstuhl is climbing on the stair.

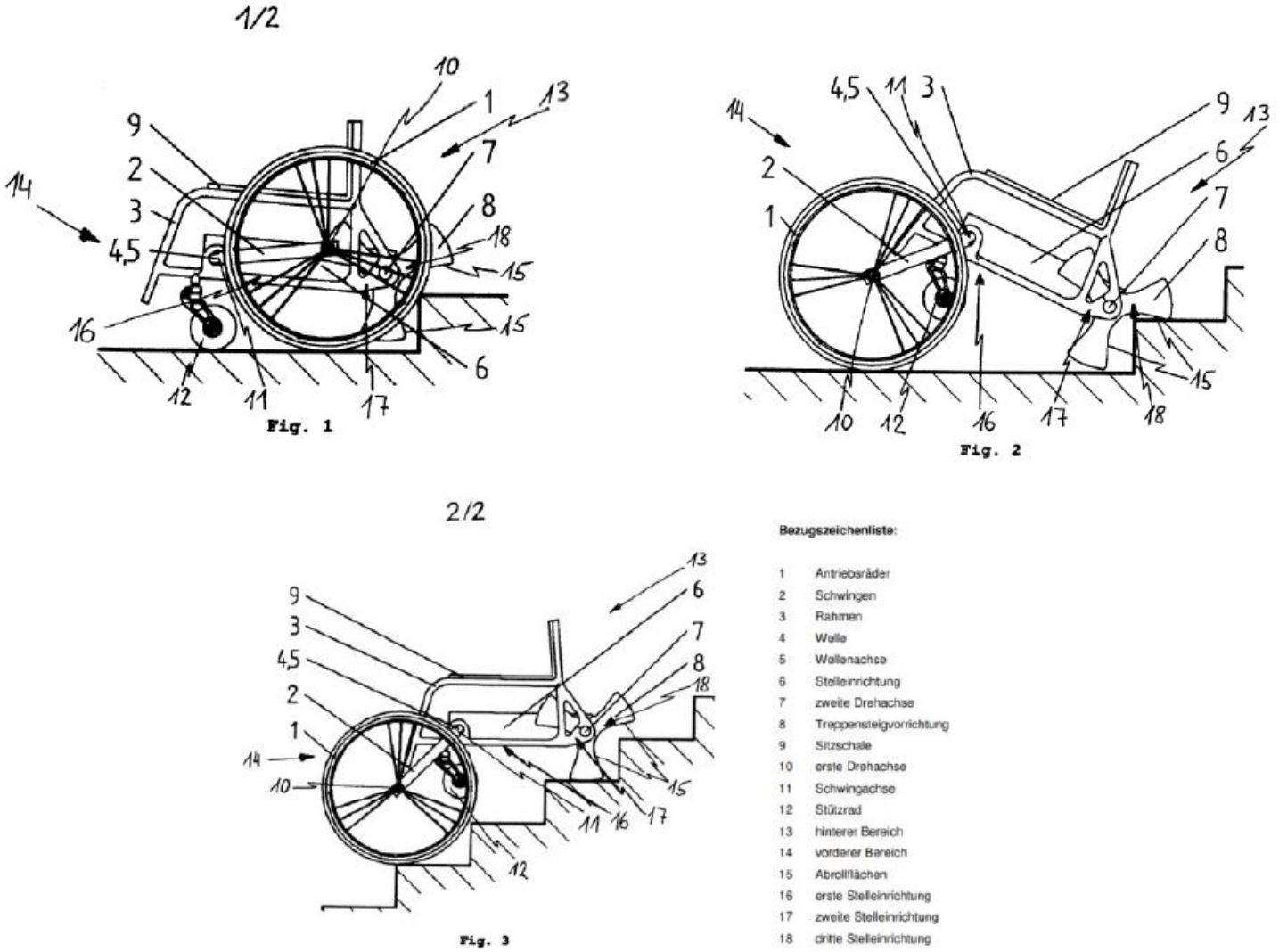

Figure 4: Malserrollstuhl in its second version according to [HF20]

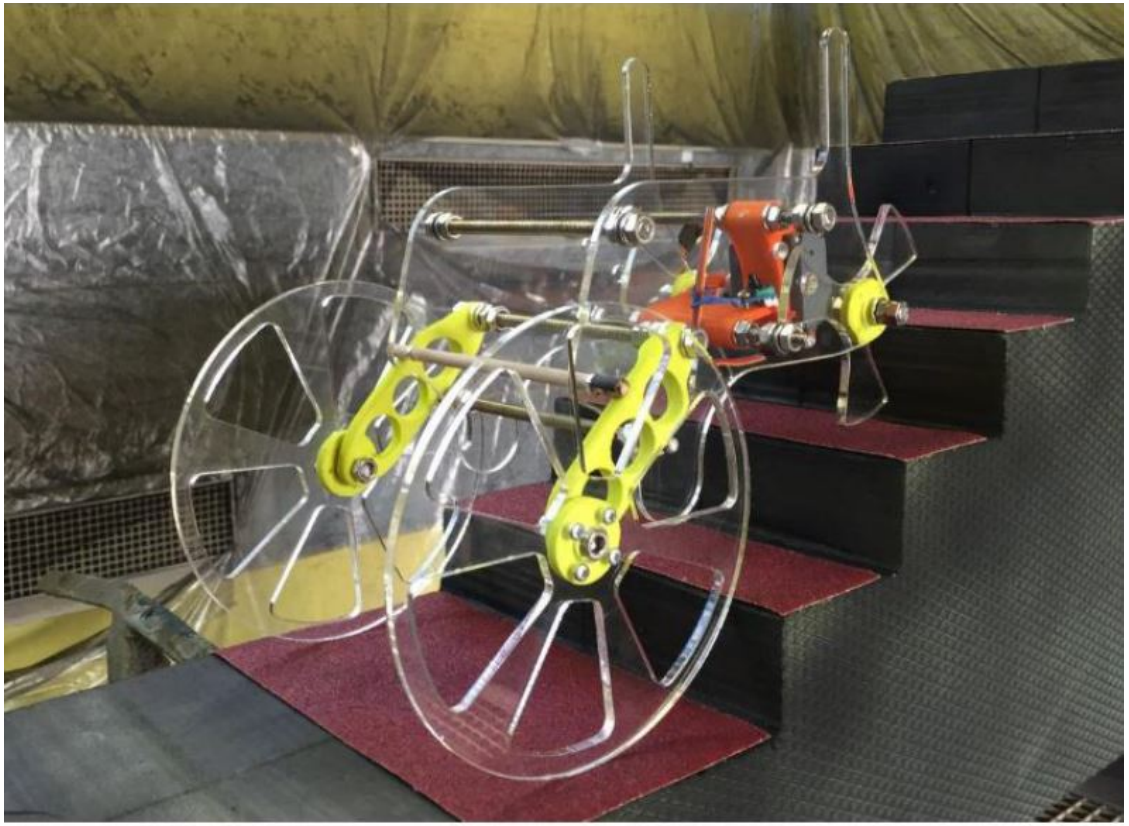

Figure 5: Malteserrollstuhl built as a model in the scaling 1:4 [Fro16]

Properties: * Purely mechanical possible * Self-empowering * Dynamic stable stair gear (low mass centre)

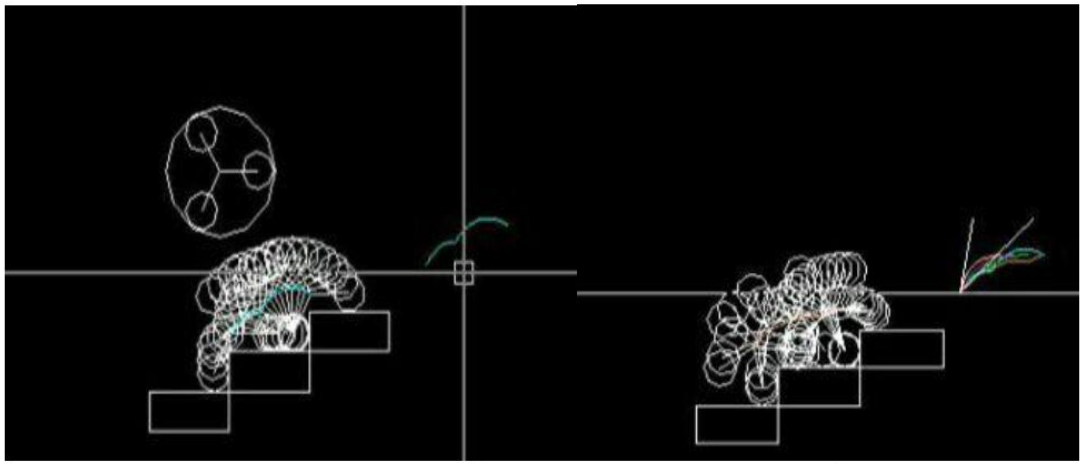

Figure 6: Trajectories of transposition of Malteser-wheel centers of mass: a – for the wheel-chair with three "Malteser-wheels" block (three teeth), b – for the wheel-chair with five "Malteser-wheels" block (five teeth) [AT19]

Logistic Transport Orgiton (TO) Model I

Transport Orgiton (**TO**) $\leftrightarrow$ general elementary transport system

1.) TO $\rightarrow$ machine M moving in World (W)

2.) M is a border relative to a subject S in AAVP*

3.) S is connected to M in a fixed way

4.) Redundant & multiple-type inter-, intra-, and trans-border-**connections** ($\leftrightarrow$) **osmotic** (person or subject & machine) and **conficient** (cooperative and efficient) TO-properties$\uparrow$

* AAVP $\leftrightarrow$ All Around View Point

Industrial Applications I

Stair Climbing as part of Transport Tasks:

- Heavy Cargo through vertical borders
- Military applications (Exosceletons)
- Construction Industry (Exosceletons)
- Logistics Industry (Multiple devices, Multiple Borders near to human e.g. delivery), AGV (Automatic Guided Vehicles)
- Human Robot Interaction (Ageing Society)
- Driverless Cars
- Combinatorial Applications: Air/Water/Earth (e.g. Drone Interaction Devices)
- Rescue and Remote Operations

Conclusion and Outlook

Limits, Conclusions and Outlook

Limits:

- TO: **M**achine is **B**order between **W**orld and **S**ubject

Conclusion:

- TO: Stability by Redundancy
- Border++ Connections ($\leftrightarrow$) $\uparrow$
- Industrial & Societal Applications$\uparrow$

Outlook:

- Further Development of Wheelchair Climbing Mechanisms: Robots, electro-mechanically controlled movement $\rightarrow$
  - power$\uparrow$
  - velocity$\uparrow$
  - safety$\uparrow$
  - autonomy$\uparrow$
  - interaction$\uparrow$
  - degree of freedom$\uparrow$

Thank you cordially for your attention!



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PS.: The presentation can later also be found at:

http://www.dr-heiden.com/Vortraege.htm

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