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WORKSHOP 1

Hochschule Fulda
University of Applied Sciences

Correlation analysis of food texture data evaluated with a high speed impact test and low speed uniaxial compression test

Presented by

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Background

- Processes in food and agricultural industry are in high speed

⇒ High mechanical stress

⇒ Damages on food

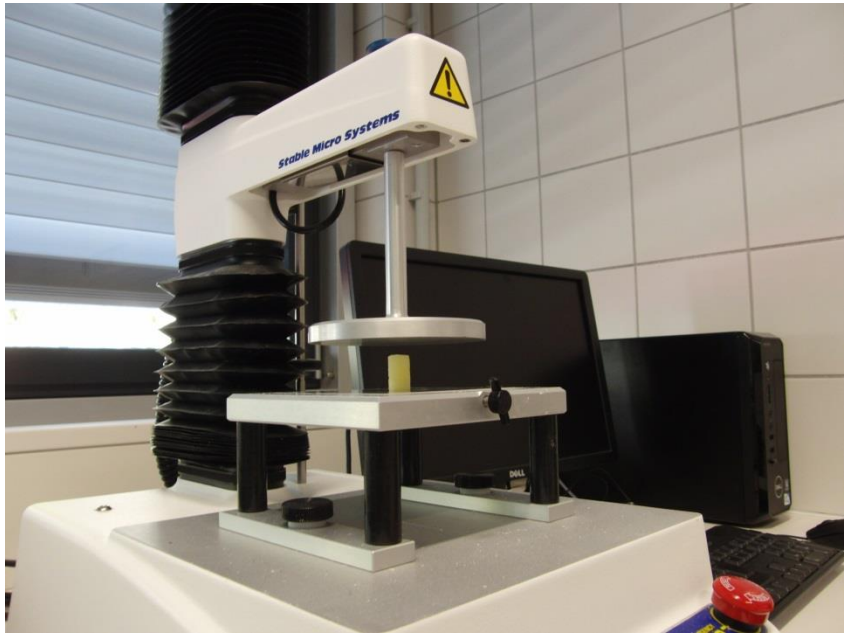
?

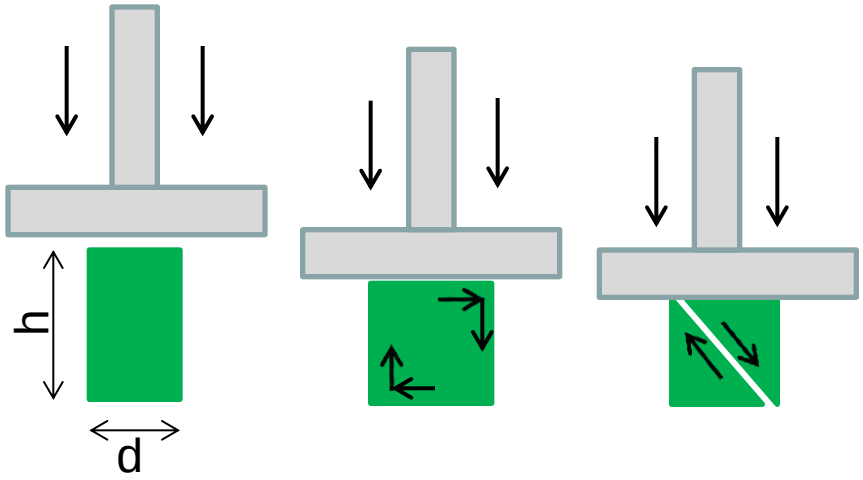
- Texture measurements are mainly based on low speed measurements
- Texture is dependent on velocity of measurement

Hypothesis

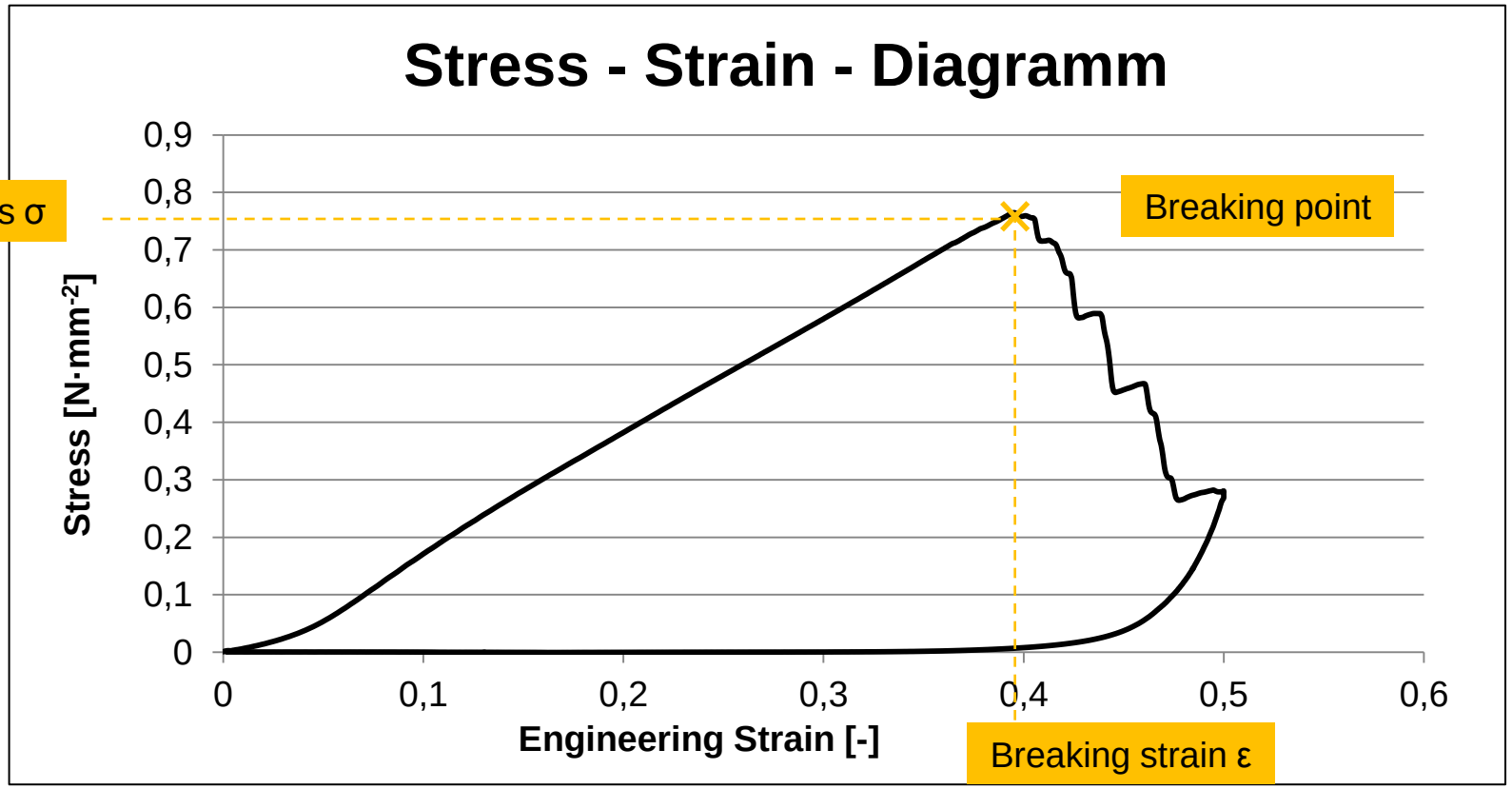
High speed measurement methods are essential to characterize the texture of foods in high speed processing units

Uniaxial – Compression test

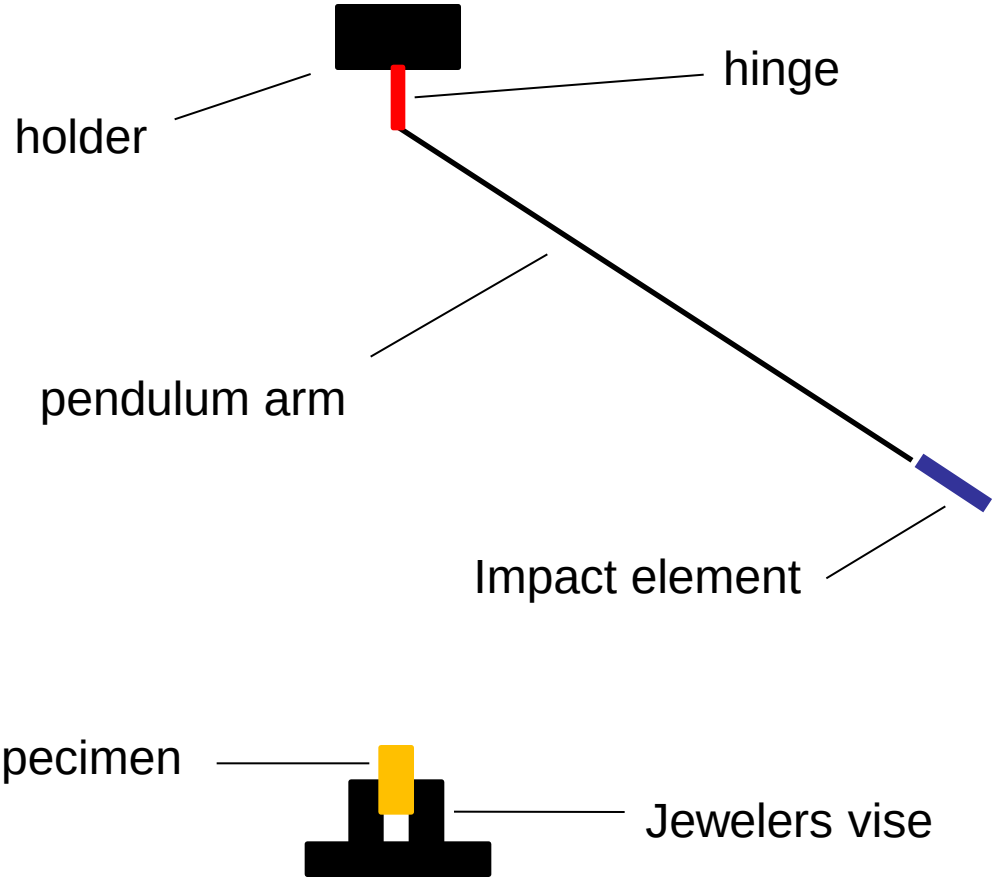




Uniaxial – Compression test

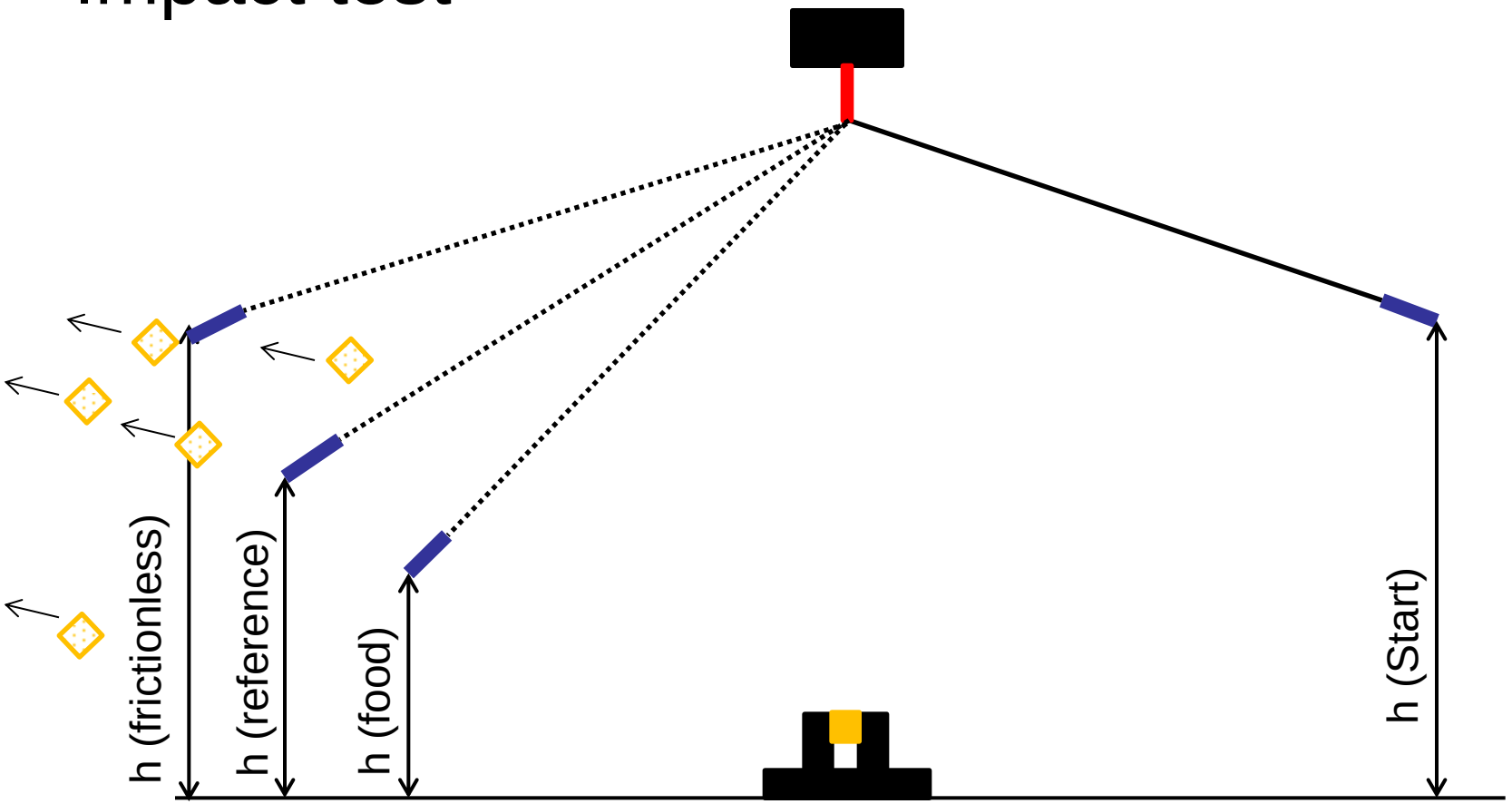


Impact test


holder
hinge
pendulum arm
Impact element
specimen
Jewelers vise

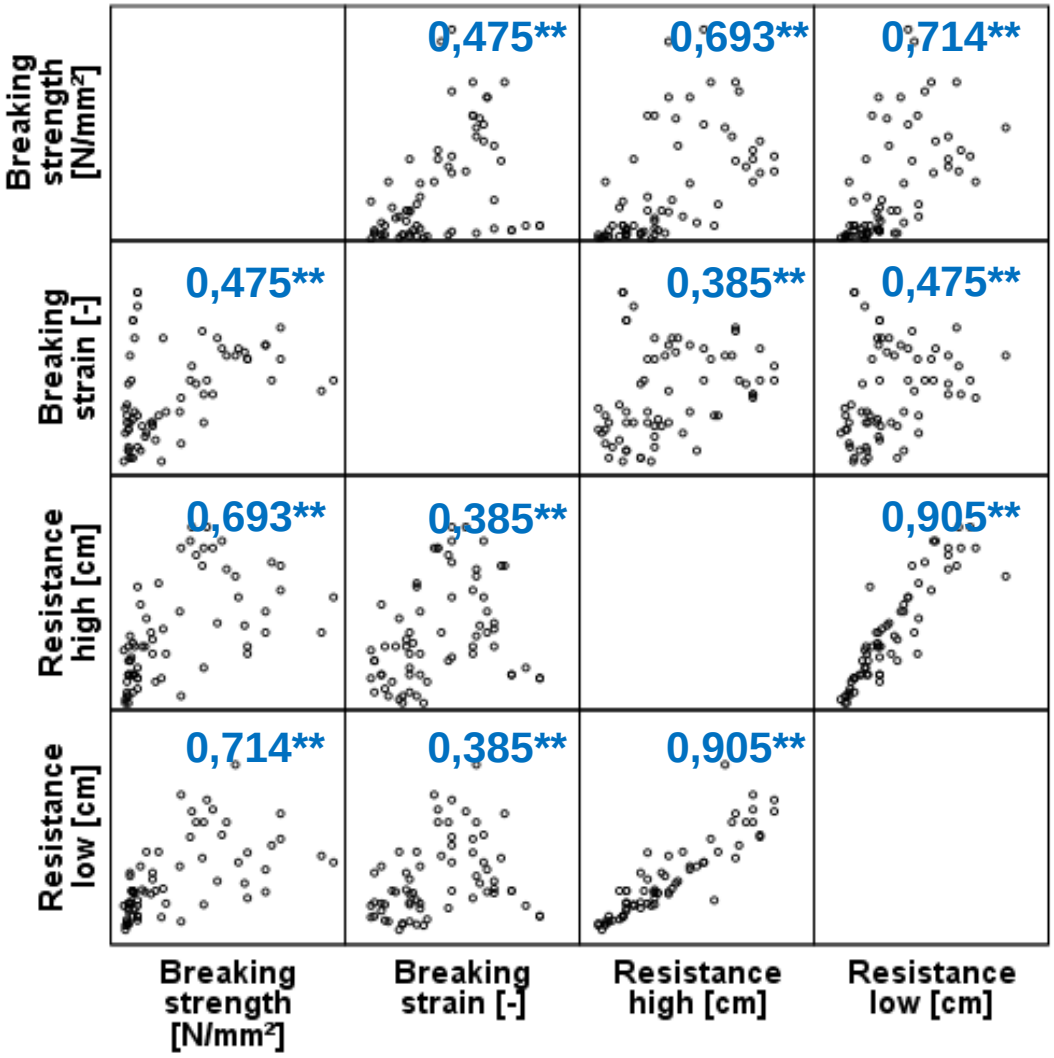
$$Resistance\ h = h\,(reference) - h\,(food)$$

Impact test



Specimens

- Vegetables with different heat treatment
- Raw and canned fruits
- Meat products
- Test made in duplicate
- Usage of the average value
- 66 different samples


Breaking strength [N/mm²]
Breaking strain [-]
Resistance high [cm]
Resistance low [cm]
0,475**
0,693**
0,714**
0,475**
0,385**
0,475**
0,693**
0,385**
0,905**
0,714**
0,385**
0,905**
Breaking strength [N/mm²]
Breaking strain [-]
Resistance high [cm]
Resistance low [cm]

Correlations of Parameters in different…

Food groups

- Meat products ↓
- Vegetables →
- Fruits ↓

Single Foods

- Potatoes ↗
- Cellery ↗
- Carrots ↗

Heat treated foods

- Raw plant foods ↗
- Treated foods →
- Time
  - Single values ↓
  - Short cooked ↓
  - Long cooked →

Conclusion

- Breaking behavior of food at high velocities is quite similar
- Medium level correlations
- Increasing correlation with homogeneity of structure

$\Rightarrow$ **High speed measurements are essential**

Selected literature

- Mohsenin: Physical properties of plant and animal materials, London 1986, ISBN: 0-677-21370-0
- Bourne: Food, texture and viscosity, 2. Edition, London 2002, ISBN: 0-12-119062-5
- Kopp, Lois: Clusteranalyse, Technische Universität Chemnitz, Chemnitz 2009
- Wiedenbeck, Züll: Klassifikation mit Clusteranalyse: Grundlegende Techniken hierarchischer und K-means-Verfahren; Mannheim 2001
- Bühl: PASW 18, Einführung in die moderne Datenanalyse, 12. Edition, München 2010, ISBN: 978-3-86894-028-2
- Dutt, Datta: Dynamic and quasi-static force and Energty requirement for detachment and breakage of chickpea pedicel and pod, Transactions of the ASAE (1999)
- Liu, MacMillan, Burrow: Pendulum test for evaluation of the rupture strength of seed pods; Journal of texture studies 25 (1994), p. 179 – 189
- Fletcher, Mohsenin, Hammerle, Tukey: Mechanical Behavior of selected fruits and vegetables under fast rates of loading, Transactions of the ASAE 68-308, p. 324 – 326 (1965)
- Arazuri, Jarén, Arana, Pérez de Ciriza: Influence of mechanical harvest on the physical properties of processing tomato (*Lycopersicon esculentum* Mill.), Journal of Food Engineering 80, p. 190 – 198 (2007)
- Liu, MacMillan, Burrow: Pendulum test for evaluation of the rupture strength of seed pods; Journal of Texture Studies 25, p. 179 – 189 (1994)
- Agulheiro Santos & Roseiro: Rheological Properties of foods, in: Arana: Physical Properties of Foods, p. 23 – 52, Boca Raton 2012, ISBN: 978-1-4398-3536-4

Thank you for your attention!

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