



High-Speed Impact Cutting of paper, wood, textile or fiber- based materials



Fraunhofer IWU



Project Details

Project coordinator	Fraunhofer IWU
Other applicants	Know-how in material characteristics and application of Wood materials, textile or fiber-composites
Sector	Wood materials, textile or fiber-composites
Call of Interest	<input checked="" type="checkbox"/> CORNET <input checked="" type="checkbox"/> EraSME <input checked="" type="checkbox"/> other national/international programmes
Advantages for SMEs, trade or industry:	<ul style="list-style-type: none">- Highest cut qualities- High productivity and efficiency- Free of chips, lubricants and admixtures



Aim of the proposal

▶ **Increased cutting speeds show for almost all materials an improved cut surface quality.**

▶ Aim of the project:

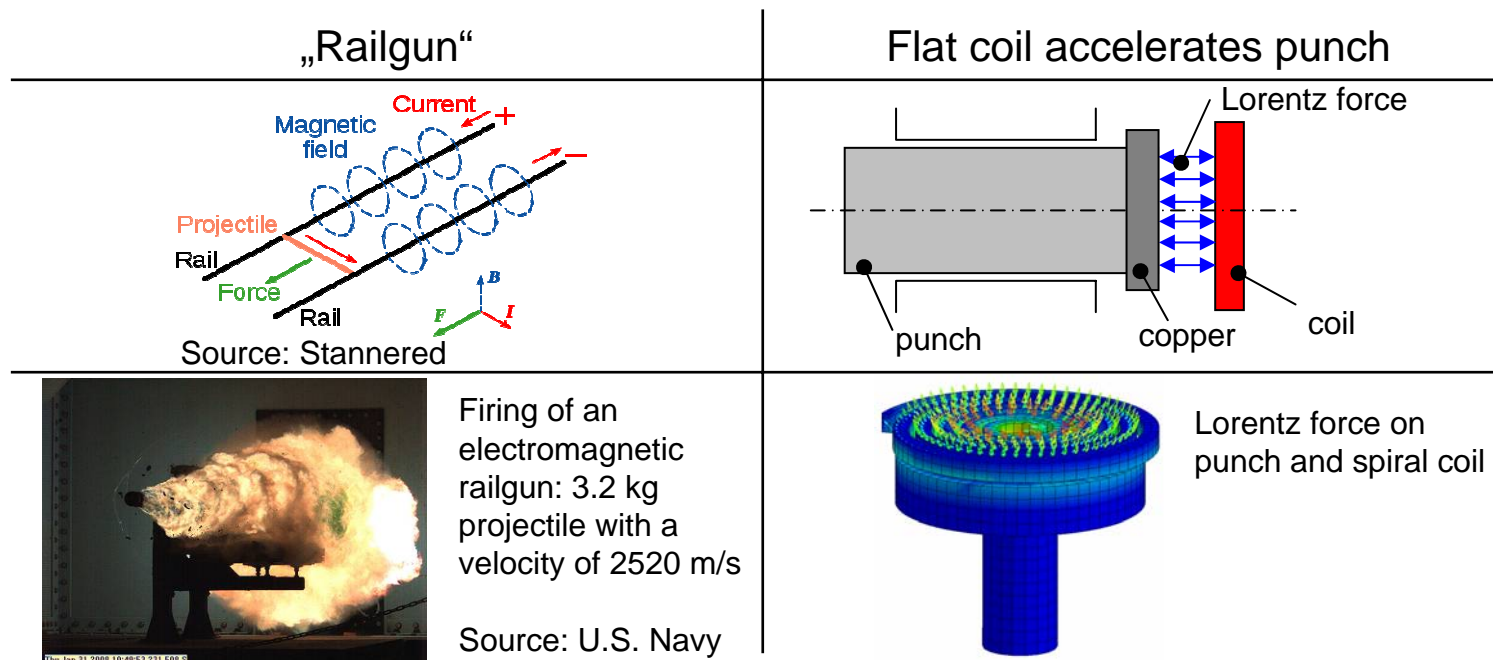
- Avoid the problem of chip removal and the according potential risks
- Provide lower cycle times

▶ Solution:

- Design and construct a tool for the high-speed impact cutting.
- Use of a plant for electromagnetic metal forming to accelerate the cutting punch
- Test of different materials and process parameters
- Analyzing and optimizing the process, its parameters and results

Approach

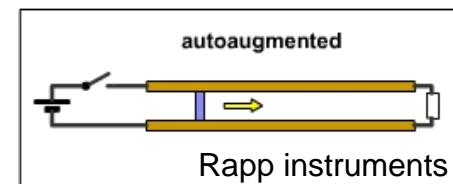
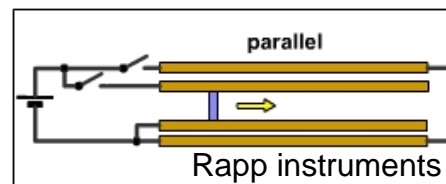
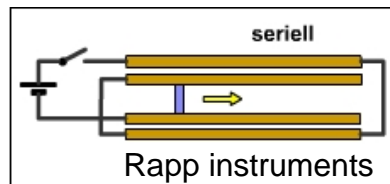
- ▶ Selection of the acceleration principle
 - Electromagnetic acceleration principles show important advantages regarding the size of the adjustable provided parameter field
 - Two possible electromagnetic acceleration principles



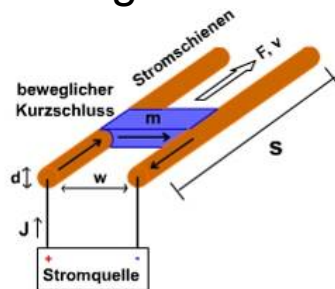
Solution

► Selection of the “Railgun”-principle

- Several possibilities to reduce the electrical current:



- Rough calculation of achievable speeds:



Rapp instruments

$$F = \frac{\mu_0 J^2}{\pi} \ln \left(1 + \frac{2w}{d} \right) \quad (1)$$

$$v = \sqrt{\frac{2Fs}{m}} \quad (2)$$

Electrical current [A]	= J = 1.000.000
Distance between rails [m]	= w = 0,3
Diameter of rails [m]	= d = 0,3
Length of acceleration track [m]	= s = 0,5
Mass of punch [kg]	= m = 2,0
Acceleration force [N]	= F = 439.432
Maximum speed [m/s]	= v = 469

v = max. speed = 469 m/s

- Supersonic Speeds are theoretical possible



Outcomes

- ▶ Establishment of high-speed impact cutting for a new field of materials
- ▶ Definition of material-specific optimal process parameters
- ▶ Deduction of construction standards for cutting tools for the separation of the shown materials
- ▶ Avoidance of chip production
- ▶ Increase in productivity compared to conventional methods
- ▶ Minimal cycle times become possible
- ▶ Elimination of the problem of chip extraction removal



Contact details

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