IAEA Workshop
Wire Saw Technology

Dipl.-Ing. Daniel Knecht
Content:

1. History
2. Function and arrangement
3. Areas of application
4. Classification
5. Tool
History

- First diamond wire saw was used in Carrara 1968
  - Experiments with a galvanic bonded diamond wire on a stationary system
- Commercialization in the 80's
- Use of diamond wire saws in almost all marble quarries in 1984
- Economic processing of the blocks instead of uncontrolled extraction by blowing
Function impulse

- Impulse occurs through hydraulic engine or electric motor
- Pneumatic cylinder holds the wire on tension
Procedure arrangement

Embracing procedure

Source: Hilti
Procedure arrangement

Depth cut with blind bores

Source: Hilti
Areas of application

- Stone quarry
- Circle wire saw
- CNC Contour cut
- Disc cutting
Areas of application

■ Building industry
  ■ Dismantling of steel and reinforced concrete structures
  ■ Decommissioning of nuclear facilities
  ■ Underwater workings
  ■ Dry cut is possible → advantage in areas poor in water

■ Decommissioning of offshore platforms, ship wrecks and submarines
## Classification

<table>
<thead>
<tr>
<th>Pro</th>
<th>Contra</th>
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<tbody>
<tr>
<td>- High flexibility in application</td>
<td>- Large cut width (11 mm)</td>
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<td>- High cut performance</td>
<td>- Sometimes rough cut surface</td>
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<td>- Remote Handling</td>
<td>- High Risk of tool cracks and so a risk of injury for people</td>
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<td>- Under water usable</td>
<td>- Preparation Drillings for fixing are necessary</td>
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<td>- Low demand for drive power</td>
<td>- High tool costs</td>
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<td>- No restrictions in the cutting depth and the shape of the work piece</td>
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<td>- Low setup-time and costs</td>
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<td>- Low noise emission</td>
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System dimensions

- Geometry
- Material
- Cut speed
- Contact force
- Input angle
- Contact length
- Tools

wire saw system

Cut time / -performance

Wear
Construction diamond wire

\[ d_s = 10.8 \text{ mm} \]

\[ l_{SA} = 25 \text{ mm} \]

1 m = 40 segments = 100 € +
Cut through a diamond segment

- There are two kinds of production procedures

**Sintered segment**
- Suspension cable
- Diamonds
- Basic body
- Sintered connection

**Galvanic segment**
- Suspension cable
- Diamonds
- Basic body
- Galvanic connection
Comparison diamond rope

- Comparison diamond rope with galvanic or sintered segments
Automated wire saw technology for underwater disassembly (ASTU)

Promoted by the Federal Ministry of Education and Research
Contents:

1. Initial position and problem
2. Objectives of the research project
3. Test stand
4. First results
5. Outlook
1. Initial position and problems

- The company Siempelkamp GmbH & Co.KG got the job of separating consoles in the nuclear fuel element basin in the nuclear power plant Obrigheim.
1. Initial position and problems

Demands

- Separation of austenitic material
- Applicable up to 8 m of water depth
- Smooth cut surfaces
- Remote handling
1. Initial position and problems

Selected procedure:
**Wire saw**

Preattempts and cold test were carried out in the test hall of the TMB.

It has been shown that the calculated cut time was crossed in practice around the 10-fold. To make the process more predictable this project was initiated.
## 2. Objectives of the research project

Test plan:

<table>
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<th>Material S235JR Attempt</th>
<th>Row 1</th>
<th>Row 2</th>
<th>Row 3</th>
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Afterwards the same program for stainless steel (1.4301)
2. Objectives of the research project

The following parameters are recorded:

- Wire speed
- Wire contact pressure
- Driving power
- Wire kind and construction
- Test sample (material and geometry)
- Water temperature
- Contact force in the entry and escape of the cut sample
- Size distribution of the filings
2. Objectives of the research project

From the ascertained data a model should be developed, that enables making predictions to the optimum cut parameters for different geometry and materials.

\[ \text{Cut time } t_s = f (v_c, F_s, P, S, G, k, \ldots) \]
3. Test stand
3. Test stand
3. Test stand

Control panel
4. First results

**Comparison Testrows**

- **S235JR** Row 1 rectangular cross
- **S235JR** Row 2 round
- **S235JR** Row 3 rectangular upright
- **1.4301** Row 4 rectangular cross

**Time [s]**

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5. Outlook

- Completion stainless steel rows
- Cuts with partial samples
- Developing model
- Edge influence
- Composite geometries
- Create a method to classify wear of diamond wires
Thank you for your attention