From weft feeders with induction motors

To advanced integral motor products with PM technology

Iro AB
Birger Johansson
• Iro / Aros
• Weft feeders
• Why PM motors
• Results
• Future
IRO AB

Main product:
Weft feeders for weaving machines

Location:
Ulricehamn Sweden

www.iro.se
Aros electronics AB
Subsidiary and partner, 20% of turnover from yarn feeder electronics

Specialised in:
• Motor controls
• Field buses
• Sensors

Location:
Mölndal Sweden

www.aros.se
The weaving process

Air/Water-Jet
- Insertion rate ≤ 1600 ppm (26 per sec)
- Max yarn thickness 0,5 mm

Rapier/Projectile
- Insertion rate ≤ 650 ppm (11 per sec)
- Max yarn thickness 5 mm
Weft feeder

Objective:

• Deliver the right amount of yarn to the weaving machine, at the right tension
Weft feeder

Permanent Magnet Motor:

- Sintered NdFeB magnets
- Concentrated winding
Weft feeder

Control system:

- Sensorless vector control
- Acceleration 0-5400 rpm in 0.4 s
Weft feeder

Production:

- Several feeder types, 4 motor sizes
- 70,000 units annually
Why PM motors
Why PM motors

- Higher performance
- Lower cost
Result

- Improved speed regulation
- Improved torque at low speed
- Lower direct material cost
- Smaller, lighter product
- Decreased energy consumption
- Lower temperature
- Increased reliability and duration of electronics
Feeder motor development

• Permanent magnets gives high power in small motors
• Stator developed from 2 kg to 0.4 kg
Result

PM motor development => new business opportunities

• Additional products to the textile machine industry
• New business outside the textile industry
Concept

Integral motor, electronics and motor optimised for each other and for the application

- Dimension
- Performance
- Integration
- Cost
Application example

Steering servo for inboard boat motor

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Voltage</td>
<td>10-36 VDC</td>
</tr>
<tr>
<td>Nominal torque</td>
<td>1.5 Nm</td>
</tr>
<tr>
<td>Peak torque</td>
<td>3.5 Nm</td>
</tr>
<tr>
<td>Nominal speed</td>
<td>3500 rpm</td>
</tr>
<tr>
<td>Control system</td>
<td>Sensorless</td>
</tr>
</tbody>
</table>

Alternative

- Hydraulics

Result

- Compact solution
- Lower total cost
- New steering possibility
Application example

Electronic shaft for the main belt in circular knitting machine

<p>| | |</p>
<table>
<thead>
<tr>
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</thead>
<tbody>
<tr>
<td>Voltage</td>
<td>300 VDC</td>
</tr>
<tr>
<td>Nominal torque</td>
<td>1.1 Nm</td>
</tr>
<tr>
<td>Peak torque</td>
<td>2.5 Nm</td>
</tr>
<tr>
<td>Nominal speed</td>
<td>3000 rpm</td>
</tr>
<tr>
<td>Control system</td>
<td>Encoder</td>
</tr>
</tbody>
</table>

Alternative
- Standard servo motor and drive

Result
- Integrated, compact unit
- Lower cost
### Application Example

<table>
<thead>
<tr>
<th>Let off / Take up for carpet machine</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Voltage</strong></td>
</tr>
<tr>
<td><strong>Nominal torque</strong></td>
</tr>
<tr>
<td><strong>Peak torque</strong></td>
</tr>
<tr>
<td><strong>Nominal speed</strong></td>
</tr>
<tr>
<td><strong>Control system</strong></td>
</tr>
</tbody>
</table>

**Before**
- Big induction motor
- Two gearboxes

**After**
- Integrated, compact unit
- One gearbox
Application example

<table>
<thead>
<tr>
<th>Individual driven leno for weaving machine</th>
</tr>
</thead>
<tbody>
<tr>
<td>Voltage</td>
</tr>
<tr>
<td>Nominal torque</td>
</tr>
<tr>
<td>Peak torque</td>
</tr>
<tr>
<td>Nominal speed</td>
</tr>
<tr>
<td>Control system</td>
</tr>
</tbody>
</table>

Alternative

- Standard servo motor and drive
- Common shaft for 2 units

Result

- Modular design
- Integrated, compact unit
- Lower cost
Application example

Steering servo for inboard boat motor

<table>
<thead>
<tr>
<th>Voltage</th>
<th>10-36 VDC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nominal torque</td>
<td>5.0 Nm</td>
</tr>
<tr>
<td>Peak torque</td>
<td>9.0 Nm</td>
</tr>
<tr>
<td>Nominal speed</td>
<td>5000 rpm</td>
</tr>
<tr>
<td>Control system</td>
<td>Sensor</td>
</tr>
</tbody>
</table>

Result

- Compact solution
- Lower total cost
- New steering possibility

Alternative
- Hydraulics
Application example

Alternative
- Induction motor
- Packing problem
- Low start torque

Friction conveyor

<table>
<thead>
<tr>
<th>Voltage</th>
<th>300 VDC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nominal torque</td>
<td>0.4 Nm</td>
</tr>
<tr>
<td>Peak torque</td>
<td>1 Nm</td>
</tr>
<tr>
<td>Nominal speed</td>
<td>1800 rpm</td>
</tr>
<tr>
<td>Control system</td>
<td>Sensorless</td>
</tr>
</tbody>
</table>

Result
- Space problem solved
- Enough start torque
On-going projects

- New products close to market introduction
- Pre-study/prototype projects
- New application requests from existing and new customers
R&D for the future

- Rotor/Magnet optimization
- Improved fill factor
- Improved heat dissipation
Summary

6 years after PM motor introduction:

- Increased performance
- Lower cost
- Increased reliability

- Growth opportunity on new applications and new markets
Thanks for listening

Questions welcome