FURTHER ENHANCEMENTS IN ACCURATE ROBOTIC AUTOMATED FIBER PLACEMENT WITH MODULAR HEADS AND HIGH-PERFORMANCE CONTINUOUS STEERING AXIS

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AFP MACHINES

• GANTRY
• POSTMILL
ROBOTS

• AFFORDABLE

• SHORT LEAD TIME

• RELIABLE

• REPEATABLE

• MODERATE FOUNDATION REQUIREMENTS

• INACCURATE FOR AEROSPACE
AFP PROCESS IMPROVEMENTS

- NEW FIBER DOES NOT REQUIRE CHILLED CREEL
AFP PROCESS IMPROVEMENTS

- MODULAR HEAD
- SIMPLIFIED TOW PATH
AFP PROCESS IMPROVEMENTS

- ROBOTIC TOOL CHANGER

- QUICK CHANGE PROCESS HEADS
AFP PROCESS IMPROVEMENTS

- PROCESS HEAD
  CHANGE VIDEO

Electroimpact Proprietary
6 x Actual Speed
AFP PROCESS IMPROVEMENTS

• SECONDARY FEEDBACK

ELIMINATES:
• BACKLASH
• GEAR TRAIN WINDUP
• GEARBOX WINDUP

EXACT POSITION OF EACH JOINT
AFP PROCESS IMPROVEMENTS

• HIGHER-ORDER KINEMATIC MODEL

• FULLY LOADED ROBOT
• HUNDREDS OF POSES THROUGHOUT WORKING ENVELOPE.
• FULLY AUTOMATED

• ACCOUNTS FOR DEFLECTIONS/ROTATIONS

• COMBINE SECONDARY FEEDBACK

• SIEMENS 840Dsl INDUSTRIAL CNC

• SIGNIFICANTLY IMPROVED ACCURACY
STEERING AXIS DESIGN CRITERIA

- INCREASE PERFORMANCE
  - SPEED
  - ACCELERATION
  - REDUCE TIME OFF-PART

- CONTINUOUS ROTATION
  - ELIMINATE CABLE MANAGEMENT
  - ELIMINATE CABLE/HOSE WEAR AND FAILURE
  - REDUCE PROGRAMMING
  - ALLOW DIRECTION OF SHORTEST ROTATION

- MAINTAIN AXIS-5 RANGE OF MOTION

- MINIMIZE WEIGHT

- MINIMIZE TOOL POINT DISTANCE
STEERING AXIS DESIGN

- REMOVE STANDARD
- ROBOT AXIS-6
STEERING AXIS DESIGN

- BELT DRIVE
  - MIN. HEIGHT
  - NESTED UTILITIES
  - NESTED ENCODER
  - MIN. BACKLASH
  - MIN. LUBRICANTS
• NESTED SLIP RINGS
  - POWER
  - SIGNAL
  - PNEUMATIC
  - 113mm SHORTER
STEERING AXIS DESIGN

• ELIMINATE CABLE MANAGEMENT

• SIMPLIFY CNC PROGRAMMING
STEERING AXIS DESIGN

• STEERING AXIS REORIENTATION PERFORMANCE
STEERING AXIS DESIGN

- PANCAKE DESIGN

- 150mm TP

- 90kg

- 3X ROTATIONAL PERFORMANCE

- ELIMINATES CABLE/HOSE WEAR/FAILURE

- FULL AXIS-5 MOTION

- SECONDARY FEEDBACK
• ROBOT CELL WITH MULTIPLE ROTATORS

• ROBOT CAN ACCESS PARTS ON BOTH SIDES OF THE LINEAR TRACK

• LASER PROJECTION FOR PLY BOUNDARIES, IDENTIFICATION OF COURSES AND TOWS, AND PROGRAMMED LAPS AND GAPS.
APPLICATIONS

- AFP FLAT CHARGE CELL WITH 2 VACUUM TABLES AND ULTRASONIC CUTTING HEAD

- MAINTENANCE AREA WITH 2 TRANSFER STANDS
SUMMARY

OFF-THE-SHELF ROBOT

SIEMENS 840Dsl SECONDARY FEEDBACK

HIGH-ORDER KINEMATICS

KUKA AXIS-6

HIGH-PERFORMANCE CONTINUOUS STEERING AXIS

TOOL CHANGER

MODULAR HEAD

ACCURATE HIGH-PERFORMANCE AFP ROBOT
QUESTIONS