

# Act 4 - Scene 4

## Rotor kinematics

Forum 2, The Hague, 24<sup>th</sup> - 26<sup>th</sup> October 2006



# VIVACE

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## Act 4 - Scene 4 - Rotor kinematics

### ROTOR KINEMATICS

### REMIND OF THE USE CASE

*An helicopter rotor system involves many parts with complex relative motions.*

*Kinematics is then a primary concern within the framework of a new rotor design through the analyses of:*

- the motions of the parts (range, spectrum, ...)*
- the collisions (ground motions, flight spectrum, ...)*

*Moreover, design and aerodynamics studies progressing, Kinematics validations are realised several times during a development.*

*Up to now, kinematics modelling and analyses are very long and boring tasks.*

*Automation is needed!*



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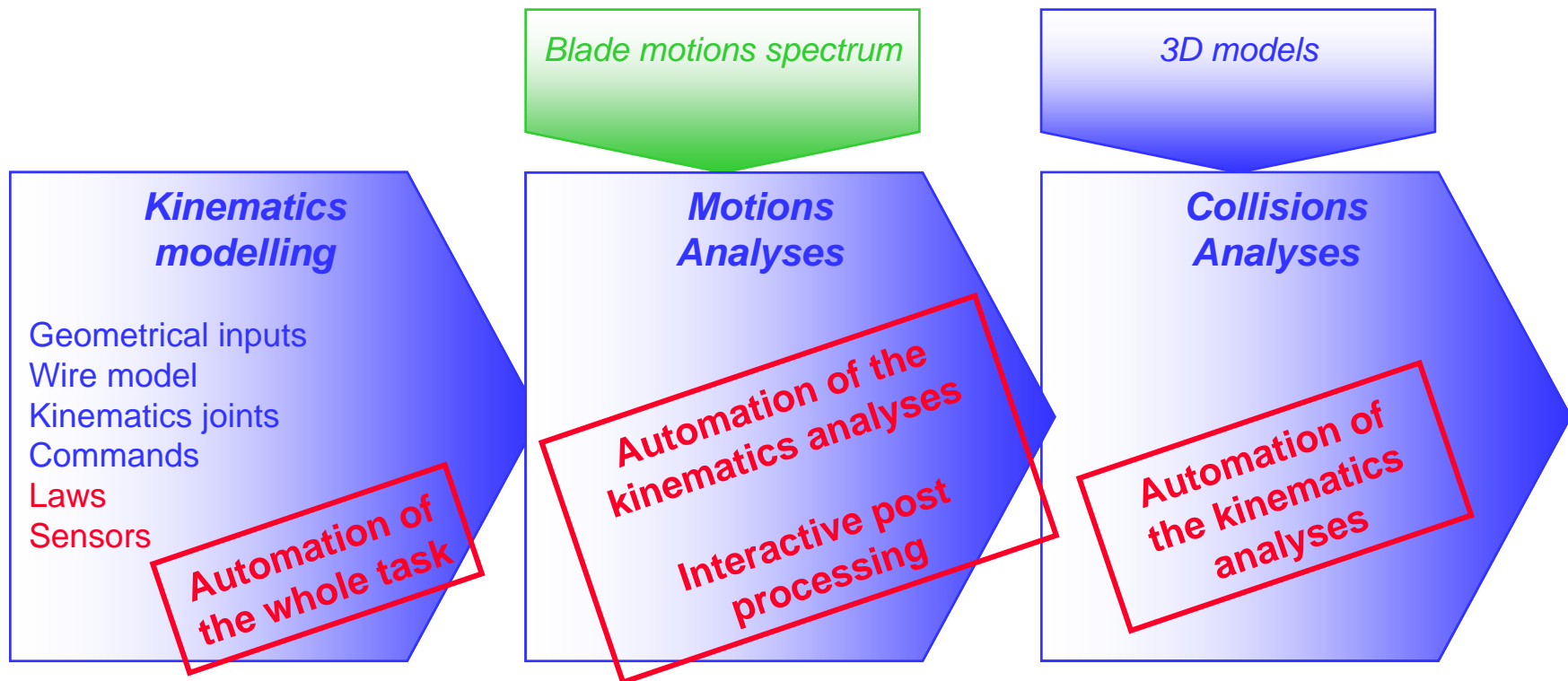
## ROTOR KINEMATICS

## SCENARIO & OBJECTIVES

Aerodynamics

Rotor design office

*The scenario at present time ... and the objectives !*





# Act 4 - Scene 4 - Rotor kinematics

## ROTOR KINEMATICS

## TECHNICAL REQUIREMENTS

### Kinematics modelling

- > **Automatic generation of a kinematics model**
  - whatever the main rotor architecture (sense, damper type, ...)
  - based on and associated with an input geometric data file
  - allowing quick update
  - allowing spectrum exploration
  - associated with a aerodynamics input data file

### Motions analyses

- > **Automatic motions analyses**
  - allowing the exploration of one flight case
  - allowing the exploration of a whole flight spectrum
  - generating an output data file with sensors recordings
- > **Interactive post processing of this output data file**

### Collisions analyses

- > **Automatic collisions analyses**
  - allowing the exploration of one flight case
  - allowing the exploration of a whole flight spectrum
  - generating an output data file with collisions identification through the parts involved, the flight case and the azimuth



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### ROTOR KINEMATICS

### DEMONSTRATION

*How to swap in few seconds*

*from a 4 bladed interblade main rotor rotating anticlockwise*

*to a 5 bladed non interblade main rotor rotating clockwise ?*

...





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## ROTOR KINEMATICS

## DEMONSTRATION

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## ROTOR KINEMATICS

TO BE DONE

### Kinematics modelling

> *Automatic generation of a kinematics model*

- *whatever the main rotor architecture (sense, damper type, ...)*
- *based on and associated with an input geometric data file*
- *allowing quick update*
- *allowing spectrum exploration*
- *associated with a aerodynamics input data file*

### Motions analyses

> *Automatic motions analyses*

- *allowing the exploration of one flight case*
- *allowing the exploration of a whole flight spectrum*
- *generating an output data file with sensors recordings*

### Collisions analyses

> *Interactive post processing of this output data file*

> **Automatic collisions analyses**

- *allowing the exploration of one flight case*
- *allowing the exploration of a whole flight spectrum*
- **generating an output data file with collisions identification through the parts involved, the flight case and the azimuth**



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### ROTOR KINEMATICS

### INNOVATION - ADAPTABILITY

*The **innovation** of our VIVACE activities lies in the development of a method and the improvement of existing tools to satisfy a very specific requirement :*

*The increase of rotor kinematics analyses productivity*

*Nevertheless, the method and the approach are easily **adaptable** to any system involving complex kinematics.*



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## QUESTIONS