



Python Automation

Introduction

Session aimed at demonstrating Python being used for OrcaFlex automation:

- What's it all about?
- Typical Uses
- Why Python?
- Examples of:

Pre-processing, Post-processing
Design Optimisation



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What's it all about?

A means to efficiently automate tasks:

- Excel Spreadsheet = 1st choice for most tasks
- OrcFxAPI – OrcaFlex Application Program Interface
- Python, MATLAB, C++, Delphi



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Why Python?

- Scripting language, automatic compile step
- Clean syntax
- Easy to learn
- Comprehensive standard library
- Well documented
- It's free



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Typical Uses

Four key ways to use Python with OrcaFlex:

- Pre-processing
- Post-processing
- As an optimization / parameter study tool
- As an External Function

<http://www.orcina.com/Support/index.php>



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Example#1: Pre-Processing

Used to efficiently generate multiple load cases

- Excel vs Python example
- Particularly useful when there are decisions to be made as part of the automation process
- Super-quick when changes are required



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Example#1: Pre-Processing

This example:

- 8x weather directions
- 2x wave periods
- 2x conditions (SOL & EOL)
- 2x vessel offsets (moorings intact & one line broken)
- =64 load cases



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Example#1: Pre-Processing

Variables:

- Wave & current directions
- Wave period (& stage durations)
- Vessel initial X & Y position
- Vessel heading
- 7x line section's line types to change

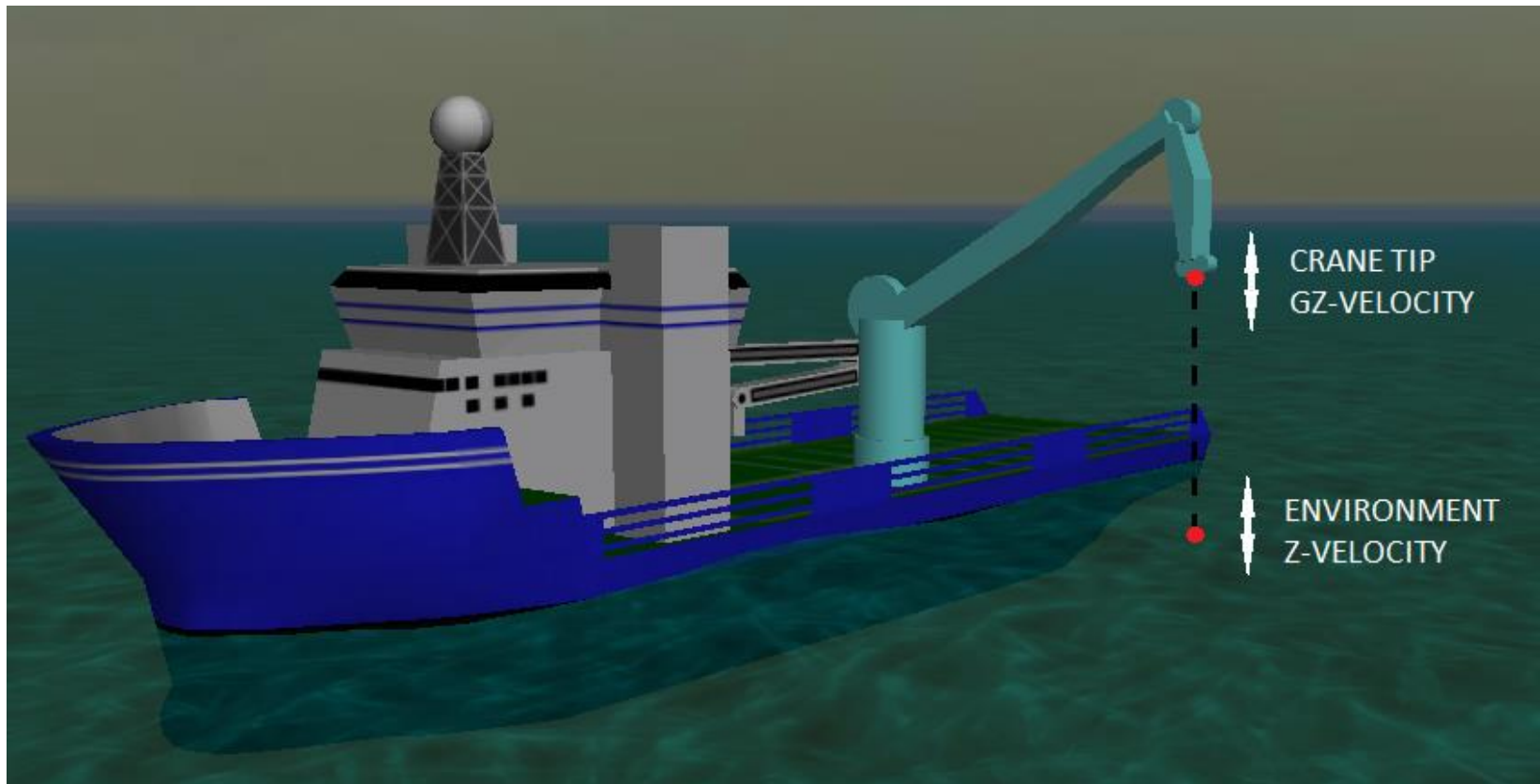
=large batch script table....



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Example#2: Post-Processing

Used to extract 'complex' results:





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Example#2: Post-Processing

The task we want Python to do is: -

At each sample time:

- Get the Crane Tip's 'GZ-Velocity', 'X' and 'Y' results.
- Use the 'X' and 'Y' results to get the Environment's Z-Velocity.
- Calculate the relative velocity & log extremes.



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Example#3: Optimisation

Using OrcaFlex as a statics calculation engine:

- Simple example to demonstrate the idea
- Using multiple static calculations to iterate towards a solution
- Huge time savings over doing the task manually



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Example#3: Optimisation

`fsolve (calcDepth, initialLength)`

- Finds solutions to equations of the form $f(x)=0$, given a starting estimate
- The equation we want to solve is:
$$f(x) = \text{towfish z position} - \text{target depth} = 0$$
- `calcDepth` is the one dimensional function $f(x)$
- `initialLength` is the starting value



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Further Information

- UGM examples on www.orcina.com soon
- OrcFxAPI Help:
www.orcina.com/SoftwareProducts/OrcaFlex/Documentation/
- Python tutorials: <http://docs.python.org>
- Learning Python book by Mark Lutz

Questions?