

Applicant

Company/organisation Chalmers University of Technology		Organisation number 556479-5598
Department/Division Applied Mechanics		Postgiro/Bankgiro/Bankkonto 4 58 93 58-3
Postal address		
Postcode 412 96	City Göteborg	Country Sweden
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Project

<input checked="" type="checkbox"/> Single project	
Project package	
Project title (in Swedish) Freedyn och vindkraftverksimuleringar	
Project title (in English) Freedyn and wind turbine system simulation	
Date for project start 2014-10-01	
Total applied financing from SWPTC 100 kSEK	Date end of project 2015-01-31

Summary of costs and financing (kSEK)

Costs (inclusive in kind)

Year	Project total cost (kSEK)	Total project cost/year kSEK				
		2014	2015	2016	2017	2018
Senior Res. salaries incl. LKP	69	51	18			
PhD-stud. salaries incl. LKP	0					
Equipment/depreciation	0					
Premesis	7	5	2			
Other equipment (<20kSEK)	0					
Conference travels	0					
Research travels	0					
Litterature	0					
Consumables	1	1				
External services	0					
Overhead	23	17	6			
In-kind work at university division	0					
In-kind work at industry	0					
Sum cash	100	74	26	0	0	0
Sum in-kind	0	0	0	0	0	0
Total sum	100	74	26	0	0	0

Financing

Financing in kSEK	Parts in kSEK and percent of the total						
	2014	2015	2016	2017	2018	Total	(%)
SWPTC financing*	68	22				90	100
In-kind	0	0				0	0
Sum cash	68	22	0	0	0	90	100
Sum in-kind	0	0	0	0	0	0	0
Total sum	68	22	0	0	0	90	100

* of which the following funding comes from the division at the university:

	2014	2015	2016	2017	2018	Total
Cash from Dynamics	7	3				10

Specification of in-kind

	Work (kSEK)	Material (kSEK)	Equipment (kSEK)	Total (kSEK)
In-kind from university/division				0
In-kind from company 1				0
In-kind from company 2				0

1. Summary of project

To use FreeDyn as a tool for system simulations and to support other SWPTC projects, additional developments are needed, as well as time to support new users. During last quarter of 2014, developments will focus on the drivetrain component, on the control system and the interface to aerodynamic simulations is to be improved. To support verification and testing of the code, a Matlab version of FreeDyn is to be developed.

2. Motivation and Connection to the research program

The system simulation tool FreeDyn as developed so far (currently version 0.6) includes base-models for all components, but further developments of drive train model and control system are needed to increase the usability of FreeDyn. In particular, the generator model does currently not allow for the proper modeling of electrical phenomena which is required to fully investigate the mechanical effects of different kinds of electrical faults (e.g. grid loss, short-circuit in one electrical phase). To make FreeDyn a more useful tool for participants of SWPTC, these features must be included. In addition, a Matlab version of FreeDyn can also simplify cooperation, as it would be simpler to develop new component models for some new users.

3. Goal

The ultimate goal is for SWPTC to have a working system simulation tool (FreeDyn) to carry out full turbine simulation. In order to ensure the relevance of many of the models related to specific components (gearbox, control, blade, generator etc.) developed within SWPTC, these models should be tested within the context of a wind turbine system to get understanding of the overall turbine behavior and how overall turbine behavior interacts with specific component behavior.

4. Background with a minor literature study

Previous work on development of FreeDyn has been carried out in project of TG3-1. There, the first part, done by Ass. Prof. Tomas Grönsted and Post-doc Xu Lei, included building the connection between components and the most of the connection parts, i.e. define how data should be transferred between different parts of the code, i.e. between the solution algorithm and the components defining mechanical response of the wind turbine subsystems (tower, blade, nacelle, etc.). To allow for fast execution and avoid proprietary software, the simulation code is written in FORTRAN.

The second part was done by the applicant, where a co-rotational framework was implemented to allow for more proper modeling of the very large deflection and movements of e.g. blades. A co-rotational framework is a very important feature for future blade model development, in particular to meet the trend of increasingly lengthier and slender blades.

5. Project description, working method and time plan

The bulk work will be carried out by the main applicant towards and can be divided into three tasks:

- 1 Development of "Matlab FreeDyn" for testing and verification
- 2 Development of drive train model
- 3 Control system

Task	2014		2015				2016				2017			
	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
1														
2														
3														

6. Expected result

The result for this project is a "Version 0.8" of FreeDyn, which compared to today's version, includes a more realistic drive train and a Matlab implementation for testing and verification. At this stage, no specific simulation results are expected.

7. Personal and cooperation partners


The main applicant will carry out the bulk of project work. Cooperation will be most closely to Theme group 3 regarding drive train model (see continuation project proposal by Viktor Berbyuk).

8. Reporting


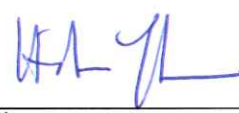
The reporting will essentially follow that of other TG3 projects, i.e. report during regular TG3 meetings where both university and industrial partners meet at least two times per year. Specific implementations will be documented in FreeDyn manual.

9. References

Approved by SWPTC

Date	2015-06-26
Director of SWPTC, signature	
Name	Ola Carlson

Project Manager

Date	2015-	Date	2015-07-01
Head of division at University, signature		Project leader, signature	
Name	Peter Folkow	Name	Håkan Johansson

Project Partners

Partner name	Date
Contact person of Partner, signature	
Name	

Partner name	Date
Contact person of Partner, signature	
Name	