

A Wiki for Sharing Substructuring Methods, Measurements and Information

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ABSTRACT

The experimental substructures focus group recently created an online wiki to provide a central repository for data, computer code, etc... to facilitate collaboration between interested researchers. The goal of the wiki is to simplify collaboration and to help those involved in substructuring research to keep informed about work that has been or will be done at other institutions. The wiki currently has a wealth of information regarding the focus group's test bed based on an Ampair wind turbine, including finite element models, test data for various components in several different configurations and other information. Contributors to the site include: Sandia National Laboratories, The University of Wisconsin-Madison, Chalmers University, the University of Massachusetts-Lowell, Delft University of Technology, University of L'Aquila and University of Stuttgart. This paper will provide an overview of the current information contained on the wiki and discuss how one can gain access to post additional measurements, publications and/or analysis results.

Keywords: Experimental Dynamic Substructuring; Impedance Coupling; Structural Modification; Admittance Modeling

1. Introduction

The dynamic substructuring focus group is a group of collaborating researchers with particular interest in experimental and analytical dynamic substructuring. The dynamic substructuring wiki has been created as an online collaboration tool and will act as a central location for sharing data, models, and computer code to assist interested researchers. This paper will give basic information about the dynamic substructuring wiki including some examples of items contained within the wiki.

The dynamic substructuring wiki can be accessed at the web address:

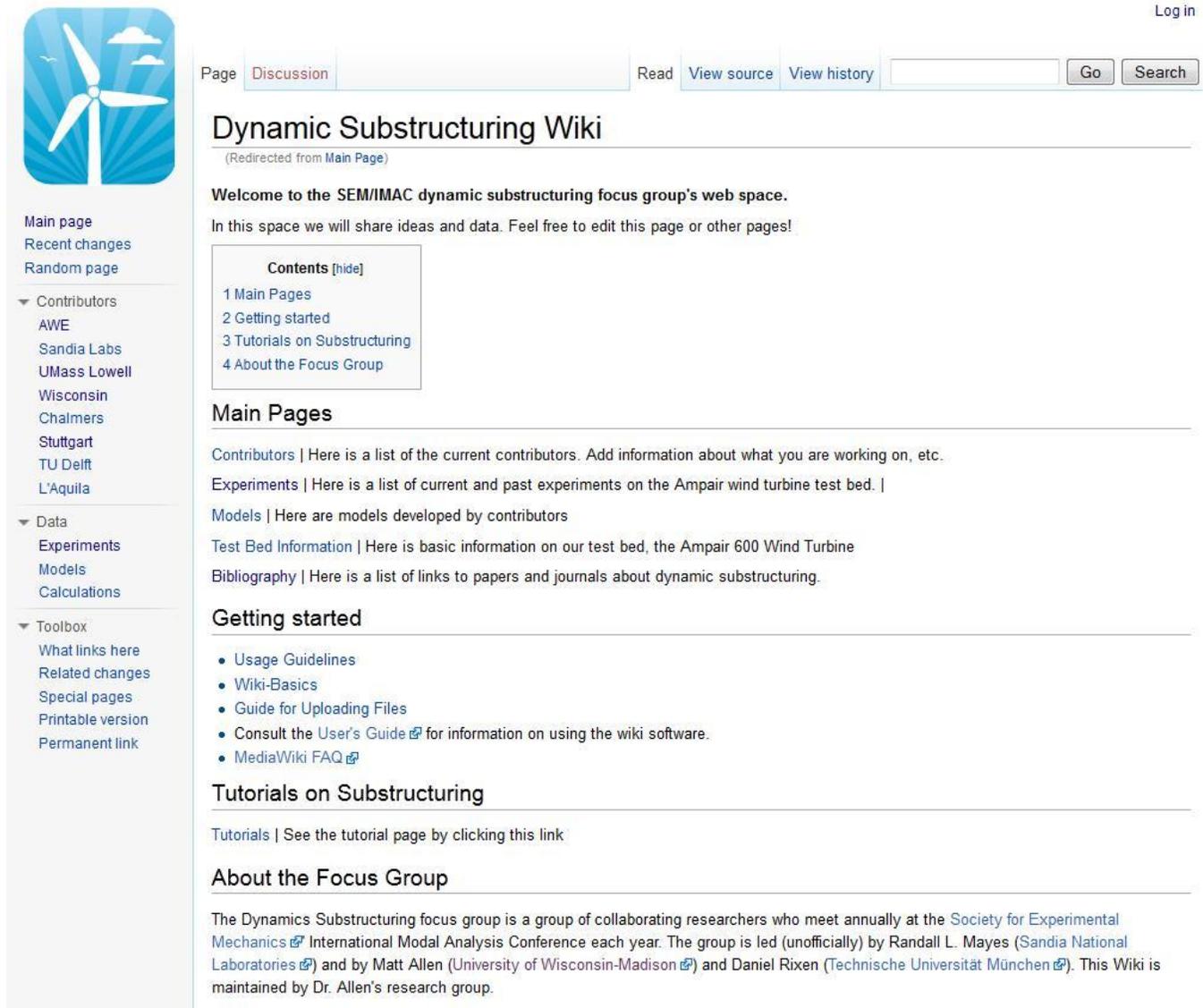
<http://substructure.engr.wisc.edu/>

This address will direct the user to the wiki main page. All of the data, models, and other information can be accessed by any visitor. To edit the wiki you must have a user account. A user may log in on any page of the wiki by typing their log-in ID and password into the box on the upper-left of the page. New users can request an account by sending an email to

substructurewiki@cae.wisc.edu. The basic functions for new users are covered in Section 3. This paper serves as an overview of the functionality and current contents of the dynamic substructuring wiki.

1.1 Wiki Organization

The figure below shows the main page that users see when they come to the wiki. You can return to this page at any time by clicking “Main page” in the left sidebar menu. Several links have been added to the main page including links to a list of contributors, experiments, and useful papers and journal entries, but much of this information can also be found using the left sidebar menu.



The screenshot shows the main page of the Dynamic Substructuring Wiki. At the top left is a blue square logo with a white wind turbine. To the right of the logo is a sidebar menu with categories: Main page, Recent changes, Random page, Contributors (listing AWE, Sandia Labs, UMass Lowell, Wisconsin Chalmers, Stuttgart TU Delft, L'Aquila), Data (Experiments, Models, Calculations), and Toolbox (What links here, Related changes, Special pages, Printable version, Permanent link). The main content area has a header with 'Page Discussion', 'Read View source View history', and a search box. Below the header is the title 'Dynamic Substructuring Wiki' with a note '(Redirected from Main Page)'. The main text says 'Welcome to the SEM/IMAC dynamic substructuring focus group's web space. In this space we will share ideas and data. Feel free to edit this page or other pages!'. A 'Contents [hide]' box lists: 1 Main Pages, 2 Getting started, 3 Tutorials on Substructuring, 4 About the Focus Group. Below this are sections for 'Main Pages' (Contributors, Experiments, Models, Test Bed Information, Bibliography) and 'Getting started' (Usage Guidelines, Wiki-Basics, Guide for Uploading Files, Consult the User's Guide, MediaWiki FAQ). The 'Tutorials on Substructuring' section has a link to the tutorial page. The 'About the Focus Group' section describes the group's activities and members.

Fig. 1 Wiki Main Page

It is important to note that the wiki is organized primarily as a searchable database, not as a static web page. Any content added to the wiki is tagged according to criteria listed below. Visitors to the site can then find what they are interested in by viewing lists of all information with a particular tag. Items in these categories can be found from any point within the site using the left sidebar menu, or using the links on the *Main page*, which is shown in Fig. 1.

- **Contributors** – see all information sorted according to who contributed it
- **Experiments** – see all experimental data, descriptions of experiments, etc...
- **Models** – see all computational models contributed

There are also a few static pages that one can navigate to from the main page.

- **Test Bed Information** – overview of Ampair test bed
- **Bibliography** – page with a list of publications relevant to substructuring
- **Tutorials** – collection of tutorials (slides, papers, etc...) providing an introduction to selected topics
- **Substructuring at IMAC** – a list of substructuring publications presented at IMAC

The “Toolbox” menu on the far left contains tools that contributors may use to add to the site.

2. Wiki Contents

There is already wealth of information uploaded to the dynamic substructuring wiki. Users can locate information on the tests and substructuring calculations that have been performed by various contributors or on substructuring methods. Users can also find models and measurement results in various forms from experiments performed by contributors. Examples of several pages of wiki content will be displayed in this section of the paper. *While this represents a significant start, the authors hope that the wiki will be used far more extensively in the future to enhance collaborations and enable new engineers, students or researchers to learn quickly from the substructuring research that has been performed.*

2.1 Contributor Pages

Each contributor should have a *Contributor* page which provides an overview of all of the information that they have added to the wiki. This is a great place to let the substructuring community know what current projects your group is working on or interested in. It is also very helpful to provide an overview of research that you have previously performed as well as links to any other websites, conference or journal articles, etc... where interested readers can learn more. The general format for a contributor page includes a summary of experiments/research completed along with current plans and links to any experiments, methods, or calculations available on the wiki. An example of the University of Wisconsin-Madison contributor page is shown in Fig. 2.

University of Wisconsin--Madison

(Redirected from Wisconsin)



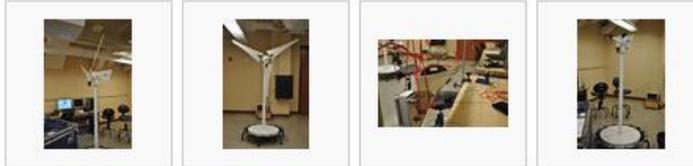
Contents [hide]

- 1 Overview
- 2 Experiments Performed
- 3 Calculations Performed
- 4 Summary of Ampair Tests
- 5 Links

Overview

[edit]

The University of Wisconsin--Madison has performed multiple tests on the turbine in various stages of disassembly. Current Plans are to perform substructuring predictions with some of these models, for instance, fixing one blade to a rigid boundary condition and attaching a blade to the disassembled turbine.



Experiments Performed

[edit]

- Tests Performed Fall 2011
 - [2-bladed Turbine Roving Hammer Test-UW Madison](#)
 - [Full Turbine Roving Hammer Test-UW Madison](#)
 - [Mass Loaded Blade Test-UW Madison](#)
 - [No-blade Turbine Roving Hammer Test-UW Madison](#)
- Tests performed by Dan Rohe (UW-Madison) and Randall Mayes (Sandia)
 - [Full Turbine](#) (forthcoming)
 - [Hub + 3 Blades](#) (forthcoming)
 - [Tower + Hub](#) (forthcoming)

Calculations Performed

[edit]

- Substructuring of UW-Madison Test Results (~Fall 2011)
 - [UW Blade to Fixed-Base](#) (forthcoming)
 - [UW Blade to 2-bladed Turbine](#) (forthcoming)
 - [UW 3 Blades to Blade-less Turbine](#) (forthcoming)
- Substructuring of Sandia Test Results (Summer 2012)
 - [Hub+blades to Hub+Tower](#) (forthcoming)
 - [Paper Describing This: RoheMayes_SubstAmpairWT_IMAC2013.pdf](#)

Summary of Ampair Tests

[edit]

- Dan Rohe's thesis contains an excellent discussion of the experiments performed at UW-Madison and the difficulties encountered. A second set of tests was performed at Sandia (will post that data when we are able) and far better results were obtained. His thesis is available below.
- [RoheD_MSThesis_SubstructuringValidation.pdf](#)

Links

[edit]

- [Matt Allen's Home Page](#)
- [College of Engineering Homepage](#)

Categories: [Contributor](#) | [Broken Links](#) | [Wisconsin](#)

Fig. 2 Example University of Wisconsin-Madison Contributor Page

The goal of the wiki is to simplify collaboration and to help those involved in substructuring research to keep informed about work that has been or will be done at other institutions. If you are a new contributor, begin by adding a simple list of projects that your group has been involved in, publications that have resulted and your contact information. In the course of their work, most researchers will receive requests to share measurements, models or computational routines used in their work. When those requests come, post these items to the wiki (rather than attaching them to an email message or posting them on some external site). Encourage your collaborators to enhance your post by adding additional notes that were helpful to them as they used your contribution. As more of this information is captured on the wiki, it will quickly become an increasingly valuable resource.

2.2 Models

A few contributions have already been added to the models section of the wiki. The Atomic Weapons Establishment contributed a detailed solid model of a blade of the Ampair turbine while Walter D'Ambrogio contributed a NASTRAN model of a blade which has already been used by several researchers, as reported in several recent IMAC papers.

Category [Discussion](#) [Read](#) [Edit](#) [View history](#) [Go](#) [Search](#)

Category:Models

Here is a list of any models we have created. To make your page appear here, tag it by adding `[[Category:Models]]` in the wiki text.

CAD Geometry for the Ampair 600 Blade: This is the blade geometry produced by AWE following scanning laser measurements averaged and surface/curve fitted using 3 Ampair 600 blades. This file ([Media:Scanned_averaged_blade_geometry.txt](#)) is actually in 'step' model format so please rename to *.stp after downloading.

Pages in category "Models"

The following 2 pages are in this category, out of 2 total.

A

- [Atomic Weapons Establishment](#)

L

- [L'Aquila](#)

Media in category "Models"

The following 2 files are in this category, out of 2 total.

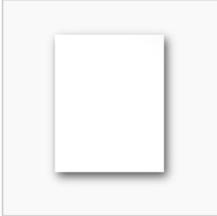
	
LAquila AMPAIR BLADE.rar 836,289 bytes	Scanned averaged blade... 443,371 bytes

Fig. 3 Page listing all contributions that have been tagged with the “Models” category

2.3 Experiments

As shown in Fig. 2 a contributor page may provide links to summaries of several experiments or substructuring calculations. If desired, each experiment may have its own description page including an overview, photos, models, and experimental data, or simply post slides from a presentation that you have given regarding your experiments. Data and information from these experiments can be uploaded directly to the wiki or linked via external web-sites. This will enable the substructuring community to learn from your work and to begin to validate new methods and calculations with real experimental data without the cost of running the experiments. Note that experiments can be tagged with the “Experiments” category tag (see Section 3.4 for additional information on category tags). An example experiment page created from a University of Wisconsin-Madison experiment is shown in Fig. 4.

2-bladed Turbine Roving Hammer Test-UW Madison

Contents [\[hide\]](#)

- 1 Details
- 2 Photos
- 3 Data and Geometry
- 4 Results

Details [\[edit\]](#)

This test was performed in early January 2012

Two sets of measurements were taken with varying accelerometer locations.

The hammer was roved over approximately 40 points on the structure to obtain a fairly dense pattern of points, primarily on the blade.

The span of the test was 0 to 800 Hz.

Photos [\[edit\]](#)

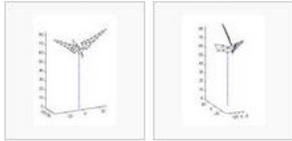


2-bladed Turbine Configuration

Data and Geometry [\[edit\]](#)

All data sets are in the universal file format. Use [WinRAR #9](#) or similar to decompress the Dataset Files

[Geometry File](#) | [Dataset 1](#) | [Dataset 2](#)



Point Resolution, Front View Point Resolution, Side View

Fig. 4 Example Experiment Page

2.4 Bibliography

The wiki bibliography can be accessed from the wiki main page. This contains links and titles of many useful papers related to dynamic substructuring. Users can add papers to this list by editing the page or sending a list of publications to the wiki administrators at substructurewiki@cae.wisc.edu. Note that an author typically retains the right to share their work in a pre-publication form (prior to reviews or formatting by the conference or journal) on a website such as this, so you may be able to upload some papers directly to the wiki site. Or, you can simply provide a link to the Digital Object Identifier (DOI) or some other external link for the papers.

2.5 User Pages

Each user can also create a user page. This lets other users know more about each other, each other's research interests, and other pertinent information. An example of a user page is shown in Fig. 5, but included details are not limited to those shown. Note that user pages can also be tagged with categories (see Section 3.4).

User:Droettgen

Dan Roettgen - droettgen(replace with at symbol)wisc.edu

Education History

Ph.D. Student, Engineering Mechanics, [University of Wisconsin [↗](#)], 2013 - Present

M.S. Mechanical Engineering, [Ohio State University [↗](#)], April 2012

B.S. Mechanical Engineering, [University of Kentucky [↗](#)], June 2009

Research Interests: Dynamics, Vibrations, Dynamic Substructuring, Controls, Fuzzy Logic

Links

- [AIAA \[↗\]\(#\)](#)
- [EAA \[↗\]\(#\)](#)
- [SEM \[↗\]\(#\)](#)
- [\[Fuzzy Logic Control Wikipedia Entry \[↗\]\(#\)\]](#)

Category: [Wisconsin](#)

User:MSAllen

Dr. Matthew S. Allen, Associate Professor, University of Wisconsin-Madison

[http://silver.neep.wisc.edu/~msallen/ \[↗\]\(#\)](http://silver.neep.wisc.edu/~msallen/)

Fig. 5 Examples of User Pages

3. User Basics

This section of the paper is intended to provide a new user with an overview of how to begin contributing to the dynamic substructuring wiki. This section of the paper will overview steps required to create an account, how to edit or contribute to the wiki, as well as some useful tools and links for uploading files and learning wiki syntax. The wiki was created using “Mediawiki,” the same package used for Wikipedia and many other sites, so a wealth of additional information and samples are available on the web.

3.1 Login or New User Set-up

In order to modify the wiki, a user must log in using the link at the top-left of any page. If you do not already have an account, the wiki administrators can create one for you by sending an e-mail the wiki e-mail address substructurewiki@cae.wisc.edu. You can also use this email to ask questions about how to use the wiki or to report any bugs or other errors that you encounter.

Once an account has been made, a new user can log in to their account. This will give the user several user options at the upper right-hand corner of the wiki, known as the user options menu (shown in Fig. 6). To set up a user-page, a user simply clicks on their user name. This will navigate to their user page which they may edit to add their contact information.



Fig. 6 User Options Menu

3.2 Editing an Existing Page

There are multiple ways to contribute to the dynamic substructuring wiki. In order to update a page, a user must navigate to that page then click the "Edit" tab near their user options menu (highlighted with a red box in Fig. 6). This will navigate the user to the editing page for the previously viewed page. All editing is done within your browser on this page. A good way to start learning the wiki-language syntax is to click "Edit" to view or copy the source code used on an existing page and see the source "wiki" code used to create it. One can do this by clicking edit on an existing page. The University of Wisconsin contributor page is a good example of how to include links, pictures, category labels, etc... It can be found at:

<http://substructure.engr.wisc.edu/substwiki/index.php/Wisconsin>

3.3 Create a New Page

The wiki-language syntax is simple and fairly intuitive, so most users should be able to begin posting content to existing pages within a few minutes of their first login. However, it may not be quite so obvious how to create a new page. One way to do this is to first create a link from an existing page to the new one. This link will initially show up as dead on the current page. For example, notice the bullet "Full Turbine (forthcoming)" in Fig. 2. The Wikimedia code used to create this was simply: "**[[UW Blade to Fixed-Base]] (forthcoming)**". When the user clicks on the link the wiki will generate a new page which one can edit and add content to. If your research group does not yet have a contributor page, you can create one by creating a user page and then adding a link to a contributor page on your user page.

3.4 Categories

When searching through pages, it is often useful to sort wiki pages by categories. Categories are keywords used to tag a page. For example, at the bottom of each contributor page there is a Categories box with the tag "Contributor". UW-Madison's contributor page has the following code at the bottom: `[[Category:Contributor]] [[Category:Broken Links]] [[Category:Wisconsin]]`. Referencing the specified categories, Wikimedia generates the box shown in Fig. 7, which a user can use to navigate to a list of all other pages with that keyword. As this wiki grows this will be a great tool for navigating to useful data and models. In this case, the page has been tagged with the categories: contributor, broken links, and Wisconsin. The tag Wisconsin can be used to easily find and navigate to other pages containing information, experiments, and other useful data associated with the University of Wisconsin-Madison. The tag for Broken Links can be used to help edit the wiki and find links that may lead to missing files or upcoming information. As you edit the wiki, feel free to add any categories that you feel would be helpful.



Fig. 7 Categories Box

3.5 Help and Support

Several wiki tools are available in the left sidebar menu under the tool box header. From the left sidebar menu, users can find links to the homepage and various contributor pages. Users can also find a recent changes page highlighting recent updates to the wiki. The "Upload File" application is also available in the sidebar providing users the ability to upload images, data sets, and other files to the wiki. It is worth noting that large files or certain file types may be blocked by the server that hosts this wiki. At the moment this cannot be corrected, but several alternatives are available, as described at

http://substructure.engr.wisc.edu/substwiki/index.php/Guide_for_Uploading_Files

In addition to these tools there are many support and help sites to help users learn the wiki language. From the main page, one can navigate to a wiki-basics guide as well as the media-wiki F.A.Q. If any additional assistance is needed e-mail the wiki administrators by sending an e-mail to substructurewiki@cae.wisc.edu.

4. Conclusion

The dynamic substructuring wiki contains a wealth of information including experiments, models, tutorials, and reference papers and this is expected to grow in the coming years. As the members of the substructuring focus group continue to collaborate, the wiki will be expanded adding more information and highlighting more research. The hope is that the focus group will find this wiki useful in educating new members while sharing the research and experimentation already being completed within the group. In the coming months and years additional content will be posted including tutorials and papers

concerning dynamic substructuring as well as additional experimental data and results. Be sure to check the wiki periodically for updates and new information.

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References

(none)