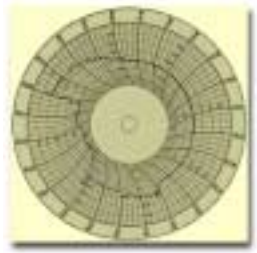
NSF/NIST GREEN Digital Library:

Green's Functions Research and Education Enhancement Network



# Building the Green's Functions Digital Library

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CTCMS Green's Functions Working Group &
NSDL Team:
Tewary, Shreve, Bartolo, Powell, Zeng

# NSF DL Programmatic History

NSDL Program
NSF: FY00 Pilots, FY01 Full

→ **DL Operational December 2002**

DLs & UG Earth Systems Education initiated FY99, continuing

DLI 2 Special Emphasis in UG Education FY 98-99

DLI 2 - NSF, et al., initiated in FY98, continuing

Digital Libraries Initiative (DLI 1) - NSF/NASA/ARPA, FY 94-97

# NSDL Vision

- Meet the needs of users in both individual and collaborative settings,
- Enable dynamic use of a broad array of materials for learning & research in digital format.
- Promote reliable anytime - anywhere access to quality collections and services, available both within and without the network.

NSF/NIST GREEN Digital Library:

Green's Functions Research and Education Enhancement Network

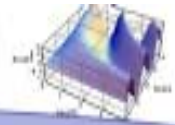
# GREEN Digital Library : Goals

- Develop collection of Green's functions and their applications for education and research.
- Serve undergraduate, graduate and professional education user communities.
- Support Green's functions research and application development in academia and industry.
- Establish a professional advisory body from academe, government, and industry.

NSF/NIST GREEN Digital Library:
Green's Functions Research and Education Enhancement Network

# GREEN Digital Library: Objectives

1. Transform Green's Functions Working Group digital resources into a digital library.
2. Enhance educational & research value by applying NIST MatML & IEEE Learning Object Metadata schema to the collection.
3. Implement review process and support tools for continual evolution of the digital collection.



NSF/NIST GREEN Digital Library:
Green's Functions Research and Education Enhancement Network

# 1. Transform discrete resources into a Digital Library

- 1994: J.R. Berger and V.K. Tewary, Workshop on Green's Functions Element Analysis
  http://www.boulder.nist.gov/div853/greenfn/wshop94.html.
- 1996: A Green's Functions Library for Advanced Materials Applications
  http://www.boulder.nist.gov/div853/greenfn/simalib.html
- 1998: V.K. Tewary, Workshop on Library of Green's Functions
  http://www.ctcms.nist.gov/~powell/green/10-15-98.html


# 1. Transform discrete resources into a Digital Library

**Green's Functions for Advanced Materials**

*The Web site and Database of the GF/BEM group aims to foster communication and collaboration among its members.*

- Uploading capabilities to handle multiple transfers of data, text, and multimedia files.
- Users profiles for automatic notification of new contributions to the site.
- User posting capabilities linked to individual contributions on the site.
- Quick & advanced searching.



**URL: www.ctcms.nist.gov/gf**

1. **Data entry and editing tools:**
   ensures that data submitted to a Working Group is consistent with and can be integrated with existing data in a seamless fashion.

2. **Data mining tools:**
   can extract useful information from the XML-represented data generated and accumulated during the operation of the work group.

3. **Domain ontology and domain visualization tools** to represent in visual form the logical relationships between tagged elements discovered in workspace data.

4. **Automated workgroup awareness / currency tools** to keep abreast of the latest literature in the emerging areas of science and technology.


# 2. Enhance value: Display Markup

**Visit matml.nist.gov**

| Magnetic Field (T) | Temperature (K) | Critical Current Density (kA/cm$^2$) |
|---|---|---|
| 0 | 3 | 3040 |

```
<table>
  <tr>
    <td align="center"><b>Magnetic Field (T) </b></td>
    <td align="center"><b>Temperature (K) </b></td>
    <td align="center"><b>Critical Current Density (kA/cm<sup>2</sup>)</b></td>
  </tr>
  <tr>
    <td align="center">0</td>
    <td align="center">3</td>
    <td align="center">3040</td>
  </tr>
<table>
```


# 2. Enhance value: Semantic Markup

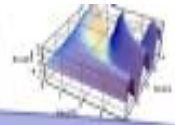
**Visit matml.nist.gov**

```
<Properties>
  <PropertyDetails>
    <Name>Critical Current Density</Name>
    <Units>kA/cm<sup>2</sup></Units>
    <DataSource>Journal</DataSource>
    <DataType>Evaluated</DataType>
  </PropertyDetails>
  <Value>3040</Value>
  <Parameters>
     <Name>Magnetic Field</Name>
     <Value type="integer">0</Value>
     <Units>T</Units>
     <Name>Temperature</Name>
     <Value type="integer">3</Value>
     <Units>K</Units>
  </Parameters>
</Properties>
```


# MatML tags

## matml.nist.gov

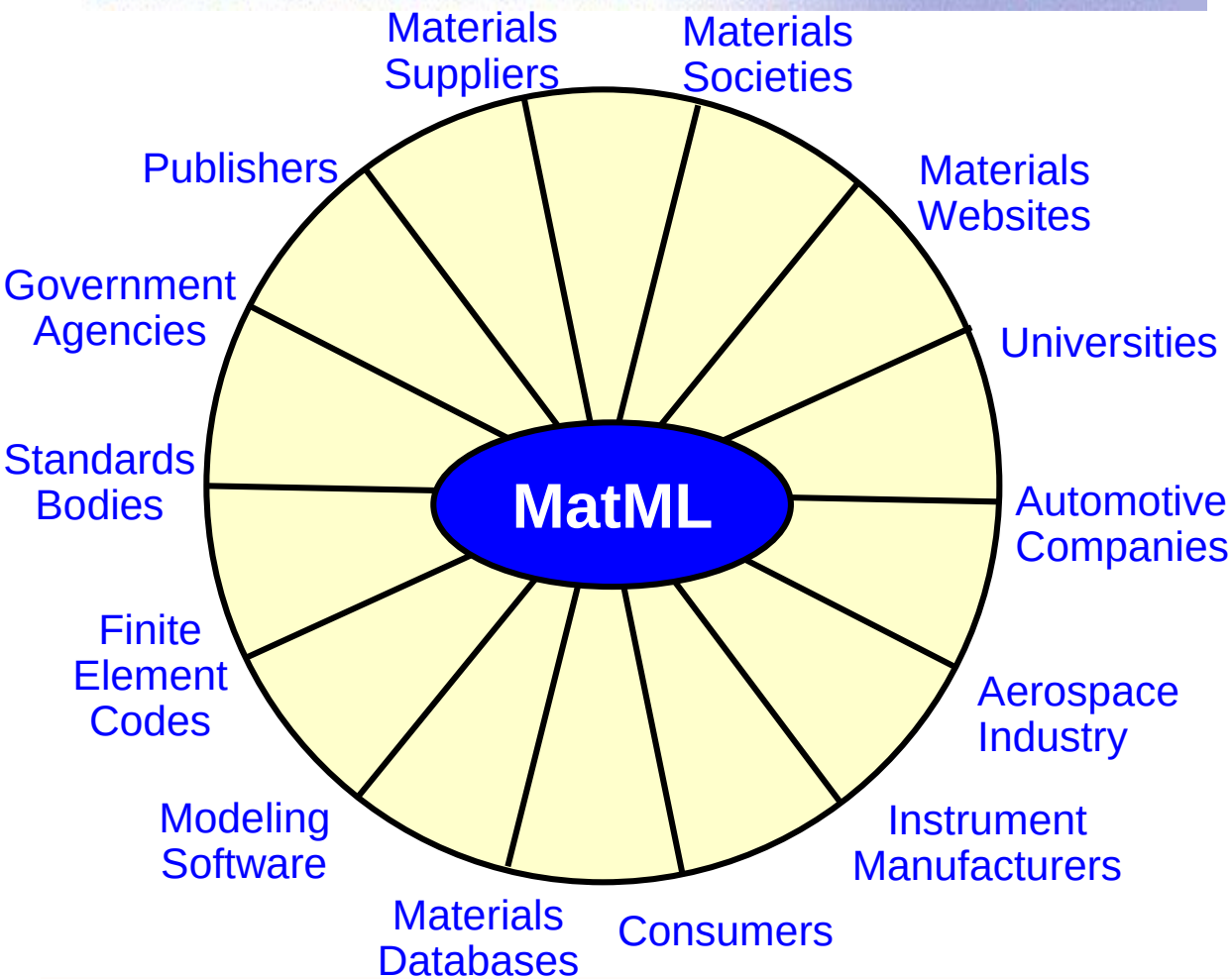
| Associate | Element | Processing |
|---|---|---|
| Associations | Form | Properties |
| BulkDetails | Formula | PropertyDetails |
| Characterization | Geometry | Qualifier |
| ChemicalComposition | Graphs | Relationship |
| Class | Material | Result |
| ComponentDetails | MatML_Doc | Shape |
| Compound | MeasurementTechnique | Source |
| Concentration | Name | Specification |
| DataSource | Notes | Subclass |
| DataType | Orientation | Terms |
| DimensionDetails | Parameters | Units |
| Dimensions | PhaseComposition | Value |





# MatML

## matml.nist.gov




- **One common materials data exchange format**
- **Program-to-program interoperability**
- **Flexible, extensible markup language**
- **Efficient data processing; rapid response**


**3. Implement a review process**

# GREEN Digital Library: Resources

- *Problem Bank:* Problems, data sets, input & output files
- *Research Bank:* Literature, Software, Multimedia resources, including visualizations, animations, and other renderings of output.
- *Teaching Bank:* Lecture notes, syllabus, Multimedia resources, including visualizations, animations, and other renderings of output.


3. Implement a review process

# GREEN Digital Library: Advisory Board.

- Contribute to the GREEN collection,
- Solicit contributions from colleagues,
- Evaluate submissions to the Green collection,
- Formalize recognition to authors for their contributions.

# GREEN Digital Library: Advisory Board

- Collaborating with other NSDL projects:
  e.g. Netlib, NEEDS,
- Sustainability
- Integration of research and teaching
- Intellectual property