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A Color Coding System for Mechanical Models

Derek Bridges

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of the LIGO Project.

California Institute of Technology
LIGO Project – MS 18-34
1200 E. California Blvd.
Pasadena, CA 91125
Phone (626) 395-2129
Fax (626) 304-9834
E-mail: info@ligo.caltech.edu

Massachusetts Institute of Technology
LIGO Project – NW17-161
175 Albany St
Cambridge, MA 02139
Phone (617) 253-4824
Fax (617) 253-7014
E-mail: info@ligo.mit.edu

LIGO Hanford Observatory
P.O. Box 1970
Mail Stop S9-02
Richland, WA 99352
Phone 509-372-8106
Fax 509-372-8137

LIGO Livingston Observatory
P.O. Box 940
Livingston, LA 70754
Phone 225-686-3100
Fax 225-686-7189

<http://www.ligo.caltech.edu/>

1 Introduction

The purpose of this document is to define a color coding system for use in SolidWorks or other CAD software. This system would apply to mechanical models and could apply only to the SUS sub-system or, with additions and modifications, could become a part of the official Drawing Requirements (E030350).

2 Color Coding System

The color coding system is primarily based on the material of each part. If a part has multiple materials (such as an Ag-plated SSTL screw), the color should be based on the most critical or outermost material (for example, an Ag-plated SSTL screw should be colored to show the silver plating, since the plating is the outermost material and the plating is what distinguishes it from a non-plated SSTL screw). A list of materials and their corresponding colors is given in Table 1.

Table 1 - Materials and Associated Colors

| Material | Color |
|---|-----------------------------------|
| Stainless Steel (302, 304, or 316) | Red |
| Ceramic | Orange |
| Fused Silica/Glass | Transparent Orange |
| Glass | Transparent or Transparent Orange |
| Stainless Steel (not known to be 302, 304, or 316 – should only be used for hardware or Initial LIGO parts) | Yellow |
| Magnets | Light Yellow |
| Silver | Green |
| Titanium | Dark Green |
| Aluminum | Blue |
| Unknown or Undetermined Material | Light Blue |
| Platinum | Teal |
| Maraging Steel | Purple |
| Fluoroelastomer | Black |
| Nitronic (helicoils) | Gray |
| Plastics (PEEK, PFA 440, et al.) | White |
| Gold | Gold |
| Copper | Copper |

The colors in the above table were chosen based on the most common materials used in recent assemblies in the SUS sub-system and the palette available in SolidWorks (colors shown in the table outlined in brown in Figure 1). If any other materials are to be added to the above list, they could be represented by a remaining color, a distinct shade of a color already in use, or the addition of a texture.

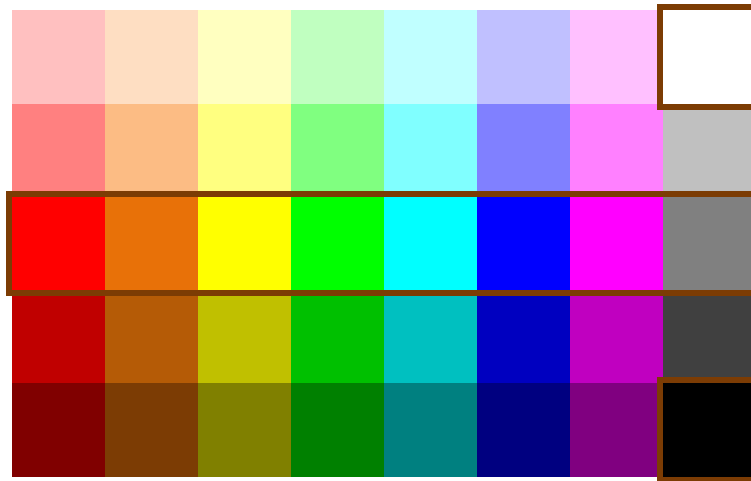


Figure 1 - SolidWorks Palette with Main Colors Highlighted

Other colors can also be used; for example, a lighter or darker shade of blue could be used for an aluminum part adjacent to another aluminum part in an assembly to show that there are two separate parts.

3 Application in SolidWorks

In order to implement this color coding system in SolidWorks, each part should be assigned an appropriate color when it is created, just as the material and other information is assigned. This can be done in SolidWorks 2007 through the use of a custom material database file; an initial version of this file, called “LIGO Materials.sldmat”, has been created to include the materials listed in Table 1. When a part is created, an appropriate material from the LIGO Materials list is selected. The part is then assigned a material name (which will appear on the drawing of the part and the bill of materials for any assembly containing the part), material properties, and an appropriate color.

The only major changes needed to implement this color coding system are to put “LIGO Materials.sldmat” into the PDMWorks vault for distribution and to assign materials (and in turn, colors) to existing parts in the vault that are widely used, especially fasteners, including screws, nuts, washers, etc.

4 Advantages and Disadvantages

The main advantage to this color coding system is that the design of part and assemblies is easier and faster. Since all parts should already have the appropriate material assigned, there should be no additional work required to use this color coding system beyond the download of the custom material database. Also, since the database contains the materials that are most commonly used (in the SUS subsystem, at least for now), it should be easier to specify only those materials that are vacuum-safe. Because it is much easier to determine the material of a particular part, it is also much easier to determine whether special hardware (such as helicoils or silver-plated screws) is

needed to join the parts in an assembly. An example of a complete color-coded assembly is shown in Figure 2 below. Note the Ag-plated SSTL screws (in green) joining SSTL parts (in red).

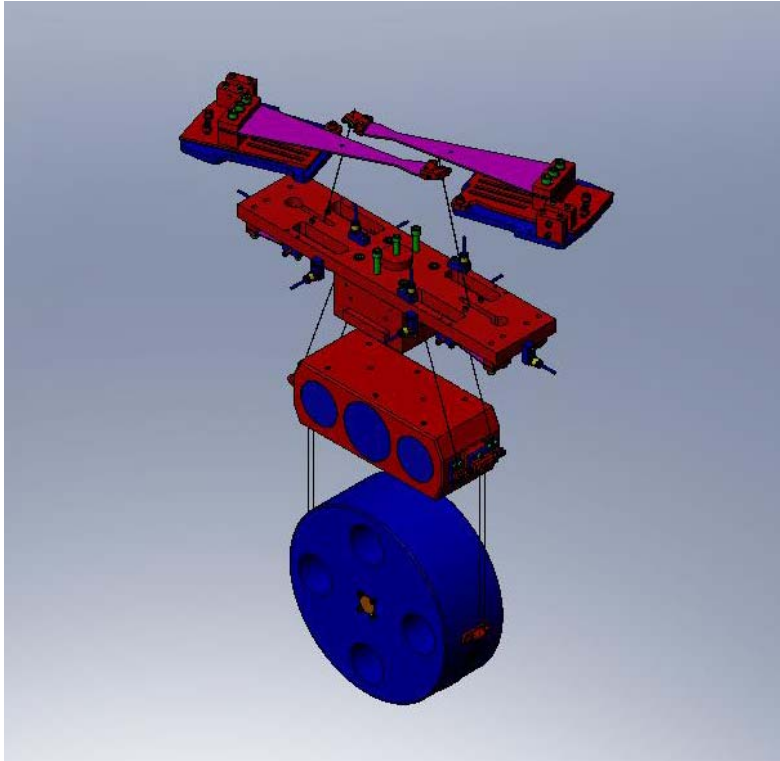


Figure 2 - Example Assembly Drawing Using Color Coding System

The primary disadvantage to this system is the fact that it may be more difficult to determine the separation between adjoining parts made from the same material. For adjoining parts in an assembly, one of the parts can be assigned a slightly different shade of the correct color.

5 Setup in SolidWorks

In order to use the color coding system with SolidWorks, follow the instructions below:

1. Open SolidWorks.
2. Check out the custom materials database “LIGO Materials.sldmat” from the PDMWorks vault (under Custom Toolbox and Templates – Templates, BOM, etc.) to the folder where your part, assembly, and drawing templates are stored.
3. Go to Tools – Options – System Options – File Locations. In the “Show folders for:” dropdown box, select “Material Databases”. Click “Add”. Navigate to the folder where your templates are stored and select it. Click “OK” and click “OK” again to close the Options window.
4. Open an existing part or start a new LIGO part.
5. In the FeatureManager Tree on the left side of the screen, one of the entries near the top of the list is the material selection – existing parts may have a material listed; new parts will display “Material <not specified>”.

6. Right-click on the material selection and choose “Edit Material”. For a new part, only the LIGO materials should be listed. For an existing part, the LIGO materials will be listed along with a “Temporary Database” which stores the material data for the current part. (Once an existing part is assigned a LIGO material, the “Temporary Database” will no longer appear.) Choose a material from the list and click “Apply”. (Note that the material names are, for the most part, in ALL CAPS, since this name is copied directly into the Material block on a LIGO drawing.)