Creation of OpenSees models is traditionally done by hand-coding source, such as C++ or tcl, or transforming data from other applications so that it can be run by OpenSees. These manual processes are quite cumbersome and increase the frequency of user error. Automatic code generation provides a means to hasten design time and reduce user errors, increasing OpenSees usability and accessibility. Additionally, a graphical picture of an OpenSees Domain provides an intuitive view of the data that assists the user with design decisions.

ODEn is designed to enable the viewing and manipulation of OpenSees Domain models (solid and structural elements) via an intuitive GUI and facilitates a more rapid design-generate-test-redesign cycle. ODEn has a Designer Window for viewing an OpenSees domain model and a Domain Inspector to inspect and modify OpenSees objects. ODEn is implemented on top of multiple subsystems, each of which is used to handle a specific language integration.

Two such tools are abconv, which is used to import meshes from abaqus and convert them to XML, and osgen which is used to generate runnable OpenSees C++ from an OpenSees XML document. The generator subsystem, osgen, allows for additional generators and/or translators to be registered, keeping the architecture open for the future.

This still allows material model generators, including prescribing spatial distribution to be specified with ease.

Abconv is used to read Abaqus mesh data and import that data into a simplified OpenSees XML document. This XML document can then be modified by ODEn for use within OpenSees.

"Part, name=Soil
 *Node
  1. 30368, 0, 13520.
  2. 29504, 0, 13520.

Within the GUI, the user can then begin adding properties to mesh elements. Elements are accessible through groups defined within the mesh, so a single property can be assigned to a large number of elements. For example, material properties such as elasticity/plasticity can be set for a large group of soil elements.

Materials are naturally also an important part of the OpenSees model and are not neglected in ODEn. Custom materials can be created and used like any other from within ODEn via an XML interface to OpenSees classes such as Template3Dep and FiberSection.

odegen takes as input an OpenSees XML instance document that it validates against the OpenSees XML Schema. This XML instance document represents a serialized OpenSees Domain and is used to generate runnable source code automatically. Essentially, osgen acts like a compiler for the XML, where the output of the compilation is source code (C++, Tcl, etc.). The generated source code can be used as is, or modified, before being executed by the OpenSees simulator.

The benefits of ODEn are its powerful capabilities of selecting finite elements such as EightNodeBrick, ElasticBeam3d, DispBeamColumn3d, etc. visually from within the designer window and modifying their properties. Properties for sets of elements may also be modified in a similar fashion.