

Week 3 Progress Report

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OpenFOAM GUI

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Executive Summary

Goal: Implement dynamic turbulence model configuration system

- ◀ Replaced static turbulence setup with dynamic UI
- ◀ Added model selection dropdown (RANS / LES / DES)
- ◀ Connected UI with backend FreeCAD properties
- ◀ Enabled persistence of user-selected models

Result: Fully reactive turbulence model selection system

Problem Statement

Issues in Existing System

- ◀ Only category selection (Laminar / RANS / LES)
- ◀ No specific model selection (kOmegaSST, kEpsilon, etc.)
- ◀ No coefficient tuning in UI
- ◀ Backend used static template

Impact

- ◀ No flexibility for real simulations
- ◀ User input not reflected in output files

Solution Overview

New System Features

- ◀ Dynamic turbulence model dropdown
- ◀ Backend properties for model + coefficients
- ◀ Real-time UI updates
- ◀ Data persistence in FreeCAD

Key Idea:

User Selection → Backend Properties → Future File Generation

Files Modified

File	Purpose
CfdPhysicsSelection.py	Backend data model
TaskPanelPhysics.ui	UI layout
TaskPanelCfdPhysicsSelection.py	Controller logic

Total: 3 files modified, 5 features added

Backend Changes

New Properties Added

- ◀ TurbulenceModel (String)
- ◀ TurbulenceModelCoeffs (Map)
- ◀ PrintCoeffs (Bool)

Purpose

- ◀ Store selected model
- ◀ Store coefficient overrides
- ◀ Control OpenFOAM printCoeffs

Impact: Data persistence enabled

UI Changes

Widgets Added

- ◀ Turbulence model dropdown (QComboBox)
- ◀ Print coefficients checkbox
- ◀ Coefficient container (QGroupBox)

Widgets Removed

- ◀ turbulenceComboBox
- ◀ turbulenceModelFrame

Impact: Clean and dynamic UI

Dynamic Model Selection Logic

Model Lists

- ◀ RANS: kOmegaSST, kEpsilon, realizableKE
- ◀ LES: Smagorinsky, WALE, dynamicKEqn
- ◀ DES: kOmegaSSTDES

Logic

- ◀ Check selected radio button
- ◀ Populate dropdown accordingly

Result: UI reacts instantly to user selection

Event Handling

Signal Connection

```
cb_turbulence_model.currentIndexChanged.connect(  
    self.onModelChanged  
)
```

accept() Update

```
self.obj.TurbulenceModel =  
    self.form.cb_turbulence_model.currentText()  
  
self.obj.PrintCoeffs =  
    self.form.check_print_coeffs.isChecked()
```

Impact: UI state saved to backend

Old vs New System

Feature	Old	New
Model Selection	Category only	Specific models
UI Response	Static	Dynamic
Persistence	No	Yes
Coefficients	Not available	Planned

Challenges Faced

- ◀ UI XML errors
- ◀ AttributeError due to removed widgets
- ◀ Dropdown not updating
- ◀ FreeCAD property caching issues

Solutions

- ◀ Fixed XML structure
- ◀ Removed stale references
- ◀ Connected signals correctly
- ◀ Restarted FreeCAD sessions

Impact of Week 3

- ◀ Enabled dynamic turbulence selection
- ◀ Removed UI bugs and crashes
- ◀ Created clean backend data model
- ◀ Prepared system for coefficient handling

Key Achievement:

Transition from static templates to dynamic system

Week 4 Plan

Next Steps

- ◀ Build dynamic coefficient input fields
- ◀ Store coefficient overrides
- ◀ Generate turbulenceProperties file
- ◀ Create central turbulence model file

Goal:

Complete full pipeline: UI → Backend → OpenFOAM Files