



FrontISTR Version 5.9 Release Notes

Release Date

2026/03/20

Changes

New Features

E-1. Support for Exodus II output

Added Exodus II as a new output format for visualization files. Output is performed using the NetCDF library and can be loaded in post-processors such as ParaView. This feature is available by specifying `WITH_NETCDF=ON` at build time.

(Issue [#736](#), solver [!527](#))

E-2. 64-bit integer support for partitioner

Changed the integer types used internally in the `hecmw_part1` partitioner to 64-bit (`size_t` , `idx_t`). This enables domain decomposition of large-scale models (roughly over 300 million mesh elements) where internal array sizes exceed the 32-bit limit, even when node and element numbers themselves are within the 32-bit range. The data types in the METIS interface were also unified to `idx_t` .

(Issue [#733](#), [#63](#), solver [!509](#))

Specification Changes

M-1. Revised input format for !ELEMENT ACTIVATION

Changed the input format of `!ELEMENT ACTIVATION` by separating the control into three mutually exclusive modes (`MODE=FIXED|AMPLITUDE|DAMAGE`). `FIXED` specifies a fixed enable/disable state for elements, `AMPLITUDE` controls activation via time history, and `DAMAGE` represents a one-way transition based on stress/strain thresholds (for fracture/damage modeling). The old format allowed simultaneous specification of `STATE` , `DEPENDS` , and `AMP` , which could lead to meaningless combinations; the new format eliminates such ambiguity. Additionally, a bug where stress/strain-dependent element activation did not function correctly and a typo in the `EPSILON` parameter of the test set were also fixed.

(Issue [#727](#), solver [!522](#), document [!19](#))

M-2. Use of BLAS-like routines in iterative solver subroutines

Replaced inline do-loop vector operations in iterative solver subroutines other than CG (BiCGSTAB, GPBiCG, etc.) with calls to BLAS-like subroutines (`hecmw_axpy_R` , `hecmw_xpay_R` , etc.) in `hecmw_solver_misc.f90` . This localizes the changes needed for future GPU offloading (OpenACC directives). OpenMP directive corrections and zero \times NaN product avoidance were also applied.

(Issue [#702](#), solver [!500](#))

M-3. Reorganization of element equivalent plastic strain (PL ESTRAIN) computation

Moved the element-averaged computation of element equivalent plastic strain (PL ESTRAIN) from the visualization function to the `fstr_NodalStress3D` function. The computation is now pre-calculated in the `ElementPlstrain_C3` function, consistent with the handling of other element-averaged quantities (stress, strain, etc.).

(Issue [#583](#), solver [!517](#))

M-4. ParaView time display support in VTK output

Changed the simulation time output format in VTK files from `TOTALTIME` to `FieldData TimeValue` . This allows ParaView to correctly recognize and display the simulation time when loading VTK files.

(solver [!524](#))

Bug Fixes

B-1. Fix for Arrhenius shift factor calculation in TRS

Fixed a bug in the Arrhenius law (`DEFINITION=ARRHENIUS`) for TRS (thermorheological simplification) where the parameter `mvar(4)` used for shift factor calculation was not correctly set in the analysis control file processing `fstr_ctrl_get_TRS`. The parameter reading process was corrected, and a test case for the Arrhenius law was added. The documentation typo (`ARRHENUS` → `ARRHENIUS`) was also fixed, and formulation and parameter descriptions were added.

(Issue [#484](#), solver [!529](#), document [!21](#))

B-2. Fix for zero element equivalent plastic strain output with smoothed elements

Fixed a bug where element equivalent plastic strain (PL ESTRAIN) output was zero in regions using smoothed elements (`FORM341=SELECTIVE_ESNS`). The plastic strain values at Gauss integration points are now correctly stored in the smoothed element structure (`gausses%plstrain`).

(Issue [#717](#), solver [!533](#))

B-3. Fix for forced CG solver in implicit dynamic analysis without contact

Since v5.7, `fstr_solve_dynamic_nlimplicit_contactSLag` has been used in implicit dynamic analysis even without contact. However, when no contact is present, the CG method was forced in `solve_LINEQ_contact_elim` regardless of the user's iterative solver setting. This caused non-symmetric problems (e.g., fluid analysis) to fail. The symmetry check was corrected so that the user-specified iterative solver is properly used. Message output for 4-DOF problems was also improved.

(Issue [#721](#), solver [!521](#))

B-4. Fix for stiffness overestimation in eigenvalue analysis with smoothed elements and orthotropic elasticity

Fixed a bug where eigenvalues were overestimated in eigenvalue analysis combining the Selective ES/NS method (`FORM341=SELECTIVE_ESNS`) with orthotropic elastic materials (`!ELASTIC, TYPE=ORTHOTROPIC`). The cause was that the `hdflag` argument for volumetric/deviatoric decomposition was not passed to `calElasticMatrix_ortho`, resulting in the full D matrix always being used and double-counting of volumetric and deviatoric components. The fix replaces the decomposition with a compliance-based projector split, which mathematically guarantees the positive semi-definiteness of D_{dev} . For isotropic materials, this coincides with the conventional bulk modulus K and the existing behavior is unchanged. New SFEM test cases for orthotropic materials (T09–T11) were added.

(Issue [#734](#), solver [!528](#), document [!20](#))

B-5. Fix for boundary condition data initialization when reading cnt files

Fixed a bug where previously specified value arrays were zeroed out when cards such as `!BOUNDARY` appeared multiple times in the analysis control (cnt) file. The same fix was applied to the reading of `!CLOAD`, `!DLOAD`, `!TEMP`, `!SPRING`, `!VELOCITY`, `!ACCELERATION`, and `!FLOAD`.

(Issue #719, solver !519)

B-6. Fix for external library include path settings

With the addition of Exodus II output support, building with `WITH_NETCDF=ON` caused `/usr/include` to be added to `FrontISTR_INCLUDE_DIRS`. On systems where an older version of MUMPS was installed, this resulted in the old MUMPS headers from `/usr/include` being included instead of the user-built newer MUMPS headers, causing a SEGV. The CMake Find modules for Metis, MKL, MUMPS, NetCDF, etc. were fixed to not add `/usr/include` to `FrontISTR_INCLUDE_DIRS` when the detected path is `/usr/include`.

(Issue #737, solver !534)

B-7. CI/CD pipeline fixes

The following CI/CD pipeline issues were fixed:

- Updated Docker-in-Docker service version to 28-dind to resolve API version incompatibility errors (Issue #720, solver !520)
- Changed to skip docker push for MR pipelines from external forks to resolve Container Registry permission errors (Issue #732, solver !526)
- Fixed sed regex in `.gitlab-ci.yml` to prevent GitLab runner from misinterpreting escape sequences (solver !525)

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