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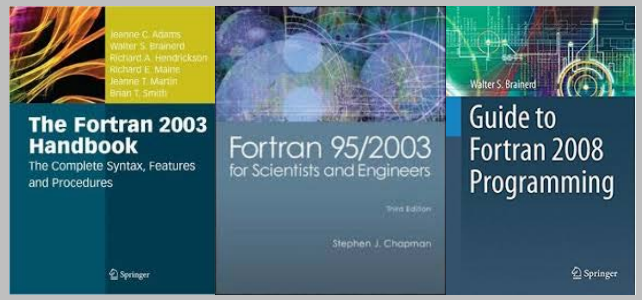

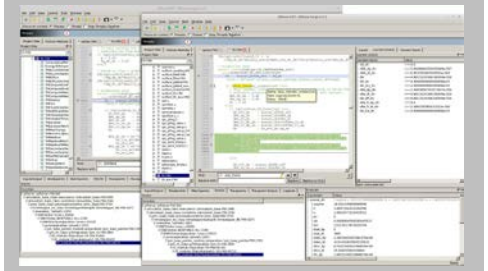

```
type :: sat_func_base_type
  type(polynomial_type), pointer :: sat_poly
  type(polynomial_type), pointer :: pres_poly
  PetscReal :: Sr
  PetscReal :: pcmax
  PetscBool :: analytical_derivative_available
contains
  procedure, public :: Init => SFBaseInit
  procedure, public :: Verify => SFBaseVerify
  procedure, public :: Test => SFBaseTest
  procedure, public :: SetupPolynomials => SFBaseSetupPolynomials
  procedure, public :: CapillaryPressure => SFBaseCapillaryPressure
  procedure, public :: Saturation => SFBaseSaturation
end type sat_func_base_type
```

Fortran 2003-2008

U.S. DEPARTMENT OF ENERGY
NNSA National Nuclear Security Administration

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Constitutive Relation Example

```
call ConstitutiveRelation(permeability, &
       porosity, soil_particle_density)
```

Constitutive Relation Example

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```
call ConstitutiveRelation(permeability, &
       porosity, soil_particle_density)
```

```
call ConstitutiveRelation(permeability, &
       porosity, soil_particle_density, &
       tortuosity, heat_capacity)
```

Constitutive Relation Example

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```
call ConstitutiveRelation(permeability, &
       porosity, soil_particle_density, &
       tortuosity, heat_capacity)
```

Constitutive Relation Example

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```
type :: material ! Fortran derived type
  real*8 :: permeability(:)
  real*8 :: porosity
  real*8 :: soil_particle_density
  real*8 :: tortuosity
  real*8 :: heat_capacity
end type material

call ConstitutiveRelation(permeability, &
       porosity, soil_particle_density, &
       tortuosity, heat_capacity)
```

Constitutive Relation Example

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```
type :: material ! Fortran derived type
  real*8 :: permeability(:)
  real*8 :: porosity
  real*8 :: soil_particle_density
  real*8 :: tortuosity
  real*8 :: heat_capacity
end type material

call ConstitutiveRelation(permeability, &
       porosity, soil_particle_density, &
       tortuosity, heat_capacity)
```

```
call ConstitutiveRelation(material)
```

Constitutive Relation Example

```
call ConstitutiveRelationOneWay(material)

call ConstitutiveRelationTheOther(material)
```

Constitutive Relation Example

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```
call ConstitutiveRelationOneWay(material)

call ConstitutiveRelationTheOther(material)

! In process model
select case(which_way)
  case(one_way)
    call ConstitutiveRelationOneWay(material)
  case(the_other)
    call ConstitutiveRelationTheOther(material)
end select
```

Constitutive Relation Example

```
call ConstitutiveRelationOneWay(material)

call ConstitutiveRelationTheOther(material)

if (one_way) then ! During setup
  ConstitutiveRelation => &
      ConstitutiveRelationOneWay
else if (the_other) then
  ConstitutiveRelation => &
      ConstitutiveRelationTheOther
endif

! In process model
call ConstitutiveRelation(material)
```

Constitutive Relation Example

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```
type :: material ! Fortran class
  real*8 :: permeability(:)
  real*8 :: porosity
  real*8 :: soil_particle_density
  real*8 :: tortuosity
  real*8 :: heat_capacity
contains
  procedure :: ConstitutiveRelation => &
                 ConstitutiveRelationTheOther
end type material
```

Constitutive Relation Example

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```
type :: material ! Fortran class
  real*8 :: permeability(:)
  real*8 :: porosity
  real*8 :: soil_particle_density
  real*8 :: tortuosity
  real*8 :: heat_capacity
contains
  procedure :: ConstitutiveRelation => &
                 ConstitutiveRelationTheOther
end type material

! In process model
call material%ConstitutiveRelation()
```