Package 'Rrelperm'

June 25, 2020

Title Generate Two- And Three-Phase Relative Permeability Estimates

Version 0.1.0

Date 2020-06-21

Description Create a table of two- and three-phase relative permeability estimates for water, and hydrocarbon phases in the reservoir. Stone, H. L. (1970) <doi:10.2118/2116-PA>. Fayers, F. J. and Matthews, J. D. (1984) <doi:10.2118/11277-PA>. Baker, L. E. (1988) <doi:10.2118/17369-MS>.

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URL https://susaenergy.github.io/Rrelperm_ws/

Imports Rcpp (>= 1.0.4.6), nleqslv, Rdpack

LinkingTo Rcpp, RcppArmadillo

RdMacros Rdpack

Suggests knitr, rmarkdown, testthat, ggplot2, ggtern, magrittr, tidyr

Language en-US

Encoding UTF-8

LazyData TRUE

VignetteBuilder knitr

RoxygenNote 7.1.0

NeedsCompilation yes

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Repository CRAN

Date/Publication 2020-06-25 14:30:14 UTC

R topics documented:

`kr2p_gl` *Generate a matrix of two-phase relative permeability data for the gas-liquid system using the modified Brooks-Corey model*

Description

The 'kr2p_gl()' creates a table of two-phase gas and liquid relative permeability data for gas and liquid saturation values between zero and one.

Usage

```
kr2p_gl(SWCON, SOIRG, SORG, SGCON, SGCRIT, KRGCL, KROGCG, NG, NOG, NP)
```

Arguments

SWCON	connate water saturation, fraction
SOIRG	irreducible oil saturation, fraction
SORG	residual oil saturation, fraction
SGCON	connate gas saturation, fraction
SGCRIT	critical gas saturation, fraction
KRGCL	gas relative permeability at connate liquid
KROGCG	oil relative permeability at connate gas
NG	exponent term for calculating krg
NOG	exponent term for calculating krog
NP	number of saturation points in the table, the maximum acceptable value is 501

Value

A matrix with gas saturation, liquid saturation, gas relative permeability, and oil relative permeability values, respectively

References

Brooks RH, Corey AT (1964). "Hydraulic Properties of Porous Media." *Hydrology Papers*, 27. https://mountainscholar.org/bitstream/handle/10217/61288/HydrologyPapers_n3.pdf.

Examples

```
rel_perm_gl <- kr2p_gl(0.15, 0.1, 0.1, 0.05, 0.05, 0.3, 1, 4, 2.25, 101)
```

kr2p_ow *Generate a matrix of two-phase relative permeability data for the water-oil system using the modified Brooks-Corey model*

Description

The 'kr2p_ow()' creates a table of two-phase water and oil relative permeability data for water and oil saturation values between zero and one.

Usage

```
kr2p_ow(SWCON, SWCRIT, SOIRW, SORW, KRWIRO, KROCW, NW, NOW, NP)
```

Arguments

SWCON	connate water saturation, fraction
SWCRIT	critical water saturation, fraction
SOIRW	irreducible oil saturation, fraction
SORW	residual oil saturation, fraction
KRWIRO	water relative permeability at irreducible oil
KROCW	oil relative permeability at connate water
NW	exponent term for calculating krw
NOW	exponent term for calculating krow
NP	number of saturation points in the table, the maximum acceptable value is 501

Value

A matrix with water saturation, oil saturation, water relative permeability, and oil relative permeability values, respectively

References

Brooks RH, Corey AT (1964). "Hydraulic Properties of Porous Media." *Hydrology Papers*, 27. https://mountainscholar.org/bitstream/handle/10217/61288/HydrologyPapers_n3.pdf.

Examples

```
rel_perm_wo <- kr2p_ow(0.15, 0.2, 0.15, 0.15, 0.4, 1, 3, 2, 101)
```

kr3p_Baker *Generate a matrix of three-phase relative permeability data for the water-gas-oil system using Baker's linear model*

Description

The 'kr3p_Baker()' creates a table of three-phase oil relative permeability data for water, gas, and oil saturation values between zero and one. This model reads the water, and gas saturation values in the three-phase region as water, and gas saturation inputs into two-phase relative permeability models

Usage

```
kr3p_Baker(
  SWCON,
  SWCRIT,
  SOIRW,
  SORW,
  SOIRG,
  SORG,
  SGCON,
  SGCRIT,
  KRWIRO,
  KROCW,
  KRGCL,
  NW,
  NOW,
  NG,
  NOG,
  NP
)
```

Arguments

SWCON	connate water saturation, fraction
SWCRIT	critical water saturation, fraction
SOIRW	irreducible oil saturation, fraction
SORW	residual oil saturation, fraction
SOIRG	irreducible oil saturation, fraction
SORG	residual oil saturation, fraction
SGCON	connate gas saturation, fraction
SGCRIT	critical gas saturation, fraction
KRWIRO	water relative permeability at irreducible oil
KROCW	oil relative permeability at connate water

KRGCL	gas relative permeability at connate liquid
NW	exponent term for calculating krw
NOW	exponent term for calculating krow
NG	exponent term for calculating krg
NOG	exponent term for calculating krog
NP	number of saturation points in the two-phase relative permeability tables, the maximum acceptable value is 501. The number of data points in the three-phase relative permeability table is (0.5 * NP * (NP + 1))

Value

A matrix with water saturation, gas saturation, oil saturation, and oil relative permeability values, respectively.

References

Baker LE (1988). "Three-Phase Relative Permeability Correlations." doi: 10.2118/17369MS, https://doi.org/10.2118/17369-MS.

Examples

```
rel_perm_wgo <- kr3p_Baker(0.15, 0.2, 0.15, 0.15, 0.2, 0.2, 0.05, 0.05, 0.4,
1, 0.3, 3, 2, 4, 2.5, 101)
```

---

kr3p_StoneII_So

Generate a matrix of three-phase relative permeability data for the water-gas-oil system using the modified Stone II model

---

Description

The 'kr3p_StoneII_So()' creates a table of three-phase oil relative permeability data for water, gas, and oil saturation values between zero and one. This model reads the oil saturation in the three-phase region as oil saturation input into two-phase relative permeability models

Usage

```
kr3p_StoneII_So(
  SWCON,
  SWCRIT,
  SOIRW,
  SORW,
  SOIRG,
  SORG,
  SGCON,
  SGCRIT,
```

```
  KRWIRO,
  KROCW,
  KRGCL,
  NW,
  NOW,
  NG,
  NOG,
  NP
)
```

Arguments

SWCON	connate water saturation, fraction
SWCRIT	critical water saturation, fraction
SOIRW	irreducible oil saturation, fraction
SORW	residual oil saturation, fraction
SOIRG	irreducible oil saturation, fraction
SORG	residual oil saturation, fraction
SGCON	connate gas saturation, fraction
SGCRIT	critical gas saturation, fraction
KRWIRO	water relative permeability at irreducible oil
KROCW	oil relative permeability at connate water
KRGCL	gas relative permeability at connate liquid
NW	exponent term for calculating krw
NOW	exponent term for calculating krow
NG	exponent term for calculating krg
NOG	exponent term for calculating krog
NP	number of saturation points in the two-phase relative permeability tables, the maximum acceptable value is 501. The number of data points in the three-phase relative permeability table is (0.5 * NP * (NP + 1))

Value

A matrix with water saturation, gas saturation, oil saturation, and oil relative permeability values, respectively.

References

Stone HL (1970). "Probability Model for Estimating Three-Phase Relative Permeability." *Journal of Petroleum Technology*, **22**(02), 214–218. ISSN 0149-2136, doi: 10.2118/2116PA, https://doi.org/10.2118/2116-PA.

Fayers FJ, Matthews JD (1984). "Evaluation of Normalized Stone's Methods for Estimating Three-Phase Relative Permeabilities." *Society of Petroleum Engineers Journal*, **24**(02), 224–232. ISSN 0197-7520, doi: 10.2118/11277PA, https://doi.org/10.2118/11277-PA.

Examples

```
rel_perm_wgo <- kr3p_StoneII_So(0.15, 0.2, 0.15, 0.15, 0.2, 0.2, 0.05, 0.05,
0.4, 1, 0.3, 3, 2, 4, 2.5, 101)
```

`kr3p_StoneII_SwSg` *Generate a matrix of three-phase relative permeability data for the water-gas-oil system using the modified Stone II model*

Description

The 'kr3p_StoneII_SwSg()' creates a table of three-phase oil relative permeability data for water, gas, and oil saturation values between zero and one. This model reads the water, and gas saturation values in the three-phase region as water, and gas saturation inputs into two-phase relative permeability models

Usage

```
kr3p_StoneII_SwSg(
  SWCON,
  SWCRIT,
  SOIRW,
  SORW,
  SOIRG,
  SORG,
  SGCON,
  SGCRIT,
  KRWIRO,
  KROCW,
  KRGCL,
  NW,
  NOW,
  NG,
  NOG,
  NP
)
```

Arguments

SWCON	connate water saturation, fraction
SWCRIT	critical water saturation, fraction
SOIRW	irreducible oil saturation, fraction
SORW	residual oil saturation, fraction
SOIRG	irreducible oil saturation, fraction
SORG	residual oil saturation, fraction

SGCON	connate gas saturation, fraction
SGCRIT	critical gas saturation, fraction
KRWIRO	water relative permeability at irreducible oil
KROCW	oil relative permeability at connate water
KRGCL	gas relative permeability at connate liquid
NW	exponent term for calculating krw
NOW	exponent term for calculating krow
NG	exponent term for calculating krg
NOG	exponent term for calculating krog
NP	number of saturation points in the two-phase relative permeability tables, the maximum acceptable value is 501. The number of data points in the three-phase relative permeability table is (0.5 * NP * (NP + 1))

Value

A matrix with water saturation, gas saturation, oil saturation, and oil relative permeability values, respectively.

References

Stone HL (1970). "Probability Model for Estimating Three-Phase Relative Permeability." *Journal of Petroleum Technology*, **22**(02), 214–218. ISSN 0149-2136, doi: 10.2118/2116PA, https://doi.org/10.2118/2116-PA.

Fayers FJ, Matthews JD (1984). "Evaluation of Normalized Stone's Methods for Estimating Three-Phase Relative Permeabilities." *Society of Petroleum Engineers Journal*, **24**(02), 224–232. ISSN 0197-7520, doi: 10.2118/11277PA, https://doi.org/10.2118/11277-PA.

Examples

```
rel_perm_wgo <- kr3p_StoneII_SwSg(0.15, 0.2, 0.15, 0.15, 0.2, 0.2, 0.05, 0.05,
0.4, 1, 0.3, 3, 2, 4, 2.5, 101)
```

---

kr3p_StoneI_So

Generate a matrix of three-phase relative permeability data for the water-gas-oil system using the modified Stone I model

---

Description

The 'kr3p_StoneI_So()' creates a table of three-phase oil relative permeability data for water, gas, and oil saturation values between zero and one. This model reads the oil saturation in the three-phase region as oil saturation input into two-phase relative permeability models

Usage

```
kr3p_StoneI_So(
  SWCON,
  SWCRIT,
  SOIRW,
  SORW,
  SOIRG,
  SORG,
  SGCON,
  SGCRIT,
  KRWIRO,
  KROCW,
  KRGCL,
  NW,
  NOW,
  NG,
  NOG,
  NP
)
```

Arguments

SWCON	connate water saturation, fraction
SWCRIT	critical water saturation, fraction
SOIRW	irreducible oil saturation, fraction
SORW	residual oil saturation, fraction
SOIRG	irreducible oil saturation, fraction
SORG	residual oil saturation, fraction
SGCON	connate gas saturation, fraction
SGCRIT	critical gas saturation, fraction
KRWIRO	water relative permeability at irreducible oil
KROCW	oil relative permeability at connate water
KRGCL	gas relative permeability at connate liquid
NW	exponent term for calculating krw
NOW	exponent term for calculating krow
NG	exponent term for calculating krg
NOG	exponent term for calculating krog
NP	number of saturation points in the two-phase relative permeability tables, the maximum acceptable value is 501. The number of data points in the three-phase relative permeability table is (0.5 * NP * (NP + 1))

Value

A matrix with water saturation, gas saturation, oil saturation, and oil relative permeability values, respectively.

References

Stone HL (1970). "Probability Model for Estimating Three-Phase Relative Permeability." *Journal of Petroleum Technology*, **22**(02), 214–218. ISSN 0149-2136, doi: 10.2118/2116PA, https://doi.org/10.2118/2116-PA.

Fayers FJ, Matthews JD (1984). "Evaluation of Normalized Stone's Methods for Estimating Three-Phase Relative Permeabilities." *Society of Petroleum Engineers Journal*, **24**(02), 224–232. ISSN 0197-7520, doi: 10.2118/11277PA, https://doi.org/10.2118/11277-PA.

Examples

```
rel_perm_wgo <- kr3p_StoneI_So(0.15, 0.2, 0.15, 0.15, 0.2, 0.2, 0.05, 0.05,
0.4, 1, 0.3, 3, 2, 4, 2.5, 101)
```

`kr3p_StoneI_SwSg` *Generate a matrix of three-phase relative permeability data for the water-gas-oil system using the modified Stone I model*

Description

The 'kr3p_StoneI_SwSg()' creates a table of three-phase oil relative permeability data for water, gas, and oil saturation values between zero and one. This model reads the water, and gas saturation values in the three-phase region as water, and gas saturation inputs into two-phase relative permeability models

Usage

```
kr3p_StoneI_SwSg(
  SWCON,
  SWCRIT,
  SOIRW,
  SORW,
  SOIRG,
  SORG,
  SGCON,
  SGCRIT,
  KRWIRO,
  KROCW,
  KRGCL,
  NW,
  NOW,
  NG,
  NOG,
  NP
)
```

Arguments

SWCON	connate water saturation, fraction
SWCRIT	critical water saturation, fraction
SOIRW	irreducible oil saturation, fraction
SORW	residual oil saturation, fraction
SOIRG	irreducible oil saturation, fraction
SORG	residual oil saturation, fraction
SGCON	connate gas saturation, fraction
SGCRIT	critical gas saturation, fraction
KRWIRO	water relative permeability at irreducible oil
KROCW	oil relative permeability at connate water
KRGCL	gas relative permeability at connate liquid
NW	exponent term for calculating krw
NOW	exponent term for calculating krow
NG	exponent term for calculating krg
NOG	exponent term for calculating krog
NP	number of saturation points in the two-phase relative permeability tables, the maximum acceptable value is 501. The number of data points in the three-phase relative permeability table is (0.5 * NP * (NP + 1))

Value

A matrix with water saturation, gas saturation, oil saturation, and oil relative permeability values, respectively.

References

Stone HL (1970). "Probability Model for Estimating Three-Phase Relative Permeability." *Journal of Petroleum Technology*, **22**(02), 214–218. ISSN 0149-2136, doi: 10.2118/2116PA, https://doi.org/10.2118/2116-PA.

Fayers FJ, Matthews JD (1984). "Evaluation of Normalized Stone's Methods for Estimating Three-Phase Relative Permeabilities." *Society of Petroleum Engineers Journal*, **24**(02), 224–232. ISSN 0197-7520, doi: 10.2118/11277PA, https://doi.org/10.2118/11277-PA.

Examples

```
rel_perm_wgo <- kr3p_StoneI_SwSg(0.15, 0.2, 0.15, 0.15, 0.2, 0.2, 0.05, 0.05,
0.4, 1, 0.3, 3, 2, 4, 2.5, 101)
```

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