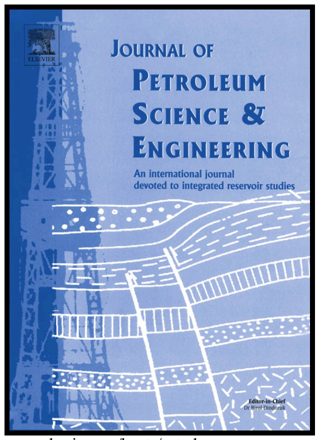




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Christoph F. Steiner, Georg M. Mittermeir

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# Applicability of the Shape-Factor Concept for Naturally Fractured Reservoirs and an Alternative Approach

**Christoph F. Steiner [a,*], Georg M. Mittermeir [b]**

[a]Montanuniversitaet Leoben, Roseggerstr 11a, 8700 Leoben, Austria

[b]Heinemann Oil GmbH, Roseggerstr 17, 8700 Leoben, Austria

christoph.steiner@stud.unileoben.ac.at

gmittermeir@heinemannoil.com

[*]**Corresponding author.**

**Abstract**

After 60 years of worldwide scientific efforts, the authors do not see a chance of formulating the matrix-fracture mass transfer rate, as it happens in naturally fractured hydrocarbon reservoirs, in one, generally applicable expression. Numerous approaches for it have been presented, but none of them considered all possible conditions and for none of them experimental evidence was presented. Therefore, the only consistent approach is a numerical calculation on a fine scale single matrix block (SMB) model. Heinemann (2004) suggested using the recovery curves resulting from SMB calculation directly in any dual continuum formulation. Mittermeir (2015) did so in material balance calculation. It is proved that this approach has the potential for being generally applicable.

**Keywords**

Matrix-fracture Fluid Transfer, Naturally Fractured Reservoirs; Dual Continua Formulation; Shape factor;



## Nomenclature

| | |
|---|---|
| $A$ | -area, [m²] |
| $d$ | -distance between two grid points, [m] |
| $F_s$ | -shape factor, [1/m²] |
| $\overline{\overline{k}}$ | -permeability tensor, [m²] |
| $\overline{\overline{k'}}$ | -scaled permeability tensor, [-] |
| $k$ | -permeability, [m²] |
| $k_{rp}$ | -relative permeability of phase $p$ , [-] |
| $L$ | -characteristic length of a matrix block or a sample, [m] |
| $\vec{n}$ | -normal unit vector, [-] |
| $N$ | -total number of neighbours, [-] |
| $P_{cpp'}$ | -capillary pressure between phase $p$ and phase $p'$, [Pa] |
| $Q_{mf}$ | -matrix-fracture exchange flow rate, [kg/s] |
| $q_p$ | -matrix-fracture interflow rate, [kg/s.m³] |
| $R$ | -recovery factor, [-] |
| $S_p$ | -phase saturation, [-] |
| $t$ | -time, [s] |
| $\vec{u}_p$ | -filtration velocity of phase $p$ , [m/s] |
| $V$ | -volume, [m³] |

## Greek Symbols

| | |
|---|---|
| $\Delta_t$ | -time difference operator, $\Delta_t x = x^{n+1} - x^n$ |
| $\phi$ | -porosity, [-] |
| $\Phi_p$ | -phase potential, [Pa] |