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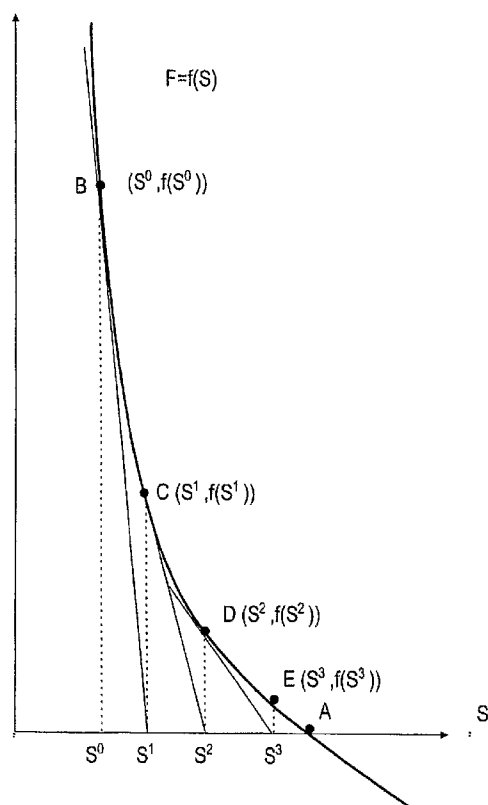
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(54) Title: STABLE METHOD AND APPARATUS FOR SOLVING S-SHAPED NON -LINEAR FUNCTIONS UTILIZING MODIFIED NEWTON-RAPHSON ALGORITHMS



(57) Abstract: An apparatus and method are provided for solving a non-linear S-shaped function $F = f(S)$ which is representative of a property S in a physical system, such as saturation in a reservoir simulation. A Newton iteration (T) is performed on the function $f(S)$ at S^V to determine a next iterative value S^{V+1} . It is then determined whether S^{V+1} is located on the opposite side of the inflection point S^C from S^V . If S^{V+1} is located on the opposite side of the inflection point from S^V , then S^{V+1} is set to S^1 , a modified new estimate. The modified new estimate, S^1 , is preferably set to either the inflection point, S^C , or to an average value between S^V and S^{V+1} , i.e., $S^1 = 0.5(S^V + S^{V+1})$. The above steps are repeated until S^{V+1} is within the predetermined convergence criteria. Also, solution algorithms are described for two-phase and three-phase flow with gravity and capillary pressure.



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