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On the convergence of a method analogous to method of tangent hyperbolas in Fréchet spaces. (English) Zbl 0752.65048

For the solution of the operator equation $P(x) = 0$ in a Fréchet space, a method analogous to the method of tangent hyperbolas is presented, where $P : X \rightarrow X$ is a nonlinear continuous mapping and $X$ is a Fréchet space with given quasinorm. The operator $P$ has the form $P(x) = x - F(x)$, and the iterative scheme of the method is given by $x_{n+1} = x_n - \Lambda_n (I - [x_n, u_n, v_n; P])^{-1} P(x_n)$ where $\Lambda_n = [x_n, u_n; P]$ and $[u_n, v_n; P]$ are the inverses of the divided differences of the first order of $P$, $[x_n, u_n, v_n; P]$ is the divided difference of the second order of $P$, $u_n = F(x_n)$, and $v_n = F(u_n) = F(F(x_n))$.

It is proved under mild conditions that the operator equation has a unique solution $x^*$ in a proper neighbourhood of the given initial point, and that the sequence generated by the method converges to $x^*$.

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MSC:
65J15 Numerical solutions to equations with nonlinear operators
47J25 Iterative procedures involving nonlinear operators

Keywords: convergence; iterative method; Fréchet space; method of tangent hyperbolas; divided difference; nonlinear operator equation