Lie symmetries of fundamental solutions of (1+2)-dimensional linear equations of Asian options pricing

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We consider a class of (1+2)-dimensional linear partial differential equations of Asian options pricing of the form

$$\frac{\partial V}{\partial \tau} + \frac{1}{2}\sigma^2 S^2 \frac{\partial^2 V}{\partial S^2} + rS\frac{\partial V}{\partial S} + f(S)\frac{\partial V}{\partial A} - rV = 0, \tag{1}$$

where $\tau \in [0;T]$, T is the term of the contract, $V = V(\tau, S, A)$ is the function of the option value, S is the value of the underlying asset; A is the average value of all available prices S of the underlying assets by the time τ, r and σ are the constants describing the risk-free interest rate and stock volatility respectively, $f(S) \neq$ const is arbitrary smooth function of the variable S.

In [2], a group classification of class equations (1) up to the G^{equiv}-equivalence was carried out, and the maximal algebras of invariance were found for the equations with nontrivial symmetry properties. By using the algorithm [1], the algebras of invariance of fundamental solutions of these equations are found. A fundamental solution of some equations under study is computed in an explicit form.

References

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