Solution of parabolic partial differential equation of the form $u_t = u_{xx} + f(x; t) \ u$ using lie symmetry analysis

The investigation of the exact solutions of nonlinear PDEs plays an important role in the study of nonlinear physical phenomena for instance in shallow water waves, uid physics, general relativity and many others. Lie Symmetry analysis has played a significant role in the construction of exact solutions to nonlinear partial differential equations (PDEs). The modern approach for finding special solutions of systems of nonlinear PDEs was pioneered by Sophus Lie at the end of the nineteenth century. A variety of methods have been developed in the past few years by Ovsyannikov, Ibragimov and others. An attempt was made by Al-Nassar in obtaining solution of second order parabolic partial differential equation of the form $u_t = u_{xx} + f(x; t) u$ using nonclassical symmetry analysis. He investigated the use of classical and nonclassical symmetry methods on the second order parabolic PDE of the form $u_t = u_{xx} + f(x; t) u$, where he used various values of $f(x; t)$, thereafter determined the symmetries and then used them to reduce the order and to solve the equation. In this work, we have focused on the solution of the parabolic partial differential equation $u_t = u_{xx} + f(x; t) u$ with $f(x; t)$ set as $xt$ and $\sin xt$ using Lie symmetry analysis. This has been achieved through the development of infinitesimal transformations, generators, prolongations and the invariant transformations of the problem. This is a big contribution to the knowledge and further research.