On applications of the generalized binomial transform

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A sequence $\{\alpha_n\}_{n\in\mathbb{N}_0}$ is associated with the generalized linear difference operator A_α, the generalized binomial transform $\mathcal{T}_\alpha$ and its inverse transform $\mathcal{B}_\alpha$, which present a correspondence between a set of infinitely continuously differentiable functions and a set of sequences. Taking different sequences $\{\alpha_n\}_{n\in\mathbb{N}_0}$, a family of transforms $\mathcal{T}_\alpha$ and $\mathcal{B}_\alpha$ is obtained.

We demonstrate the use of properties of the operator A_α, transforms $\mathcal{T}_\alpha$ and $\mathcal{B}_\alpha$ for mapping elementary functions, their derivatives and integrals to sequences. That enables us to map differential and integral equations and their solutions to difference equations and their solutions. We make use of the $\mathcal{T}_\alpha$-transform to map Bessel's differential operator $\frac{d}{dx}x\frac{d}{dx}$ to Bessel's difference operator $\Delta n\nabla$, and Bessel's differential equation and its solutions to a difference equation and its solutions. Apart from that, applications are concerned with obtaining solutions of differential equations of the classical orthogonal polynomials, and some combinatorial identities.