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# Properties of multivalent functions associated with the integral operator defined by the hypergeometric function

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## Abstract

In this paper, we introduce a new class of multivalent functions by using a generalized integral operator defined by the hypergeometric function. Some properties such as inclusion, radius problem and integral preserving are considered.

**MSC:** 30C45; 30C50

**Keywords:** Bazilevic functions; multivalent functions; integral operator; hypergeometric functions

## 1 Introduction and preliminaries

Let  $A_p$  denote the class of functions  $f(z)$  of the form

$$f(z) = z^p + \sum_{n=p+1}^{\infty} a_n z^n \quad (p \in \mathbb{N} = \{1, 2, 3, \dots\}), \quad (1.1)$$

which are analytic in the open unit disc  $E$ . Also  $A_1 = A$ , the usual class of analytic functions defined in the open unit disc  $E = \{z : |z| < 1\}$ . A function  $f \in A_p$  is a  $p$ -valent starlike function of order  $\rho$  if and only if

$$\operatorname{Re} \frac{zf'(z)}{f(z)} > \rho, \quad 0 \leq \rho < p, z \in E.$$

This class of functions is denoted by  $S_p^*(\rho)$ . It is noted that  $S_p^*(0) = S_p^*$ . Let  $f(z)$  and  $g(z)$  be analytic in  $E$ , we say  $f(z)$  is subordinate to  $g(z)$ , written  $f \prec g$  or  $f(z) \prec g(z)$  if there exists a Schwarz function  $w(z)$ ,  $w(0) = 0$  and  $|w(z)| < 1$  in  $E$ , then  $f(z) = g(w(z))$ . In particular, if  $g$  is univalent in  $E$ , then we have the following equivalence

$$f(z) \prec g(z) \iff f(0) = g(0) \text{ and } f(E) \subset g(E).$$

For any two analytic functions  $f(z)$  and  $g(z)$  with

$$f(z) = \sum_{n=0}^{\infty} b_n z^{n+1} \quad \text{and} \quad g(z) = \sum_{n=0}^{\infty} c_n z^{n+1}, \quad z \in E,$$

# Multivalent Functions

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web fractional crystallization is a method of refining substances based on differences in solubility it fractionates via differences in crystallization forming of crystals if a mixture of two or more substances in solution are allowed to crystallize for example by allowing the temperature of the solution to decrease the precipitate will

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web the percent recovery of the unknown was 78 shown in calculation 2 meaning again a significant amount of mass was lost during the recrystallization process the melting range of the unknown was observed to be 64 66 c and thus can be identified as biphenyl which has a melting range of 69 71 c

**chem 162 lab 4 162 lab 4 report fractional crystallization** - Oct 05 2023

web data calculations and graphs part i fractional crystallization of  $\text{KNO}_3$  with  $\text{NH}_4\text{Fe}(\text{SO}_4)_2 \cdot 6\text{H}_2\text{O}$  impurity a starting components fract crystallization 0 step 3 mixture before first crystallization

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web fractional crystallization lab 3 scale tray tub trough ice water salt of the rock variety stirring rod funnel hot plate bunsen burner beaker tongs procedure measure the mass of the beakers and record next measure 50 ml of the  $\text{NaCl}$   $\text{KNO}_3$  solution into the graduated cylinder then pour into the beaker

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web fractional crystallization lab calculations 14th international symposium on industrial crystallization sep 25 2022 this conference provides a forum for discussion of the advances in the theory and practice of crystallization as it relates to the production of bulk crystalline materials crystallization apr 01 2023

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web in chemistry fractional crystallization is a method of refining substances based on differences in their solubility it fractionates via differences in crystallization forming of crystals