

## Initial Value Problems in Quaternionic Analysis

Uğur Yüksel and Usman Yakubu Abbas

*Atilim University, Ankara, Turkey*

### Abstract

Recently the initial value problem

$$\begin{aligned}\partial_t u &= \mathcal{L}u := \sum_{i=1}^3 A^{(i)}(t, x) \partial_{x_i} u + B(t, x)u + C(t, x) \\ u(0, x) &= u_0(x)\end{aligned}$$

has been solved uniquely by N. Q. Hung [1] using the method of *associated spaces* constructed by W. Tutschke [2] in the space of generalized regular functions in the sense of quaternionic analysis satisfying the equation

$$\mathcal{D}_\alpha u := \mathcal{D}u + \alpha u = 0, \quad \alpha \in \mathbb{R}$$

where  $\mathcal{D} = \sum_{j=1}^3 e_j \partial_{x_j}$  is the DIRAC operator, and  $t$  is the time variable. Only sufficient conditions has been obtained in [1] for the operators  $\mathcal{L}$  and  $\mathcal{D}_\alpha$  to be associated.

In the present talk we will prove necessary and sufficient conditions for the underlined operators to be associated. This criterion makes it possible to construct all linear operators  $\mathcal{L}$  for which the initial value problem with an arbitrary initial generalized regular function is always solvable. Further we will correct a mistake made in the calculation of the interior estimate in [1].

**Key Words:** Initial value problems, associated operators, quaternionic analysis, Dirac operator.

## References

- [1] N. Q. Hung, Initial Value Problems in Quaternionic Analysis with a Disturbed Dirac Operator, *Adv. appl. Clifford alg.*, Vol. 22, Issue 4 (2012), pp. 1061-1068.
- [2] W. Tutschke, *Solution of initial value problems in classes of generalized analytic functions*, Teubner Leipzig and Springer Verlag, 1989.