1 Theme: Optical Technology

2 Subject: the Nonlinear Schrödinger Equation

Project name: SOLving the nonlineAR Schrödinger equation (SOLAR)

3 Background

Various forms of the nonlinear Schrödinger equation (NLSE) are the commonly used mathematical models for signal propagation inside fibers. Channel models based on the NLSE offer accurate predictions of signal evolution and are adopted for many applications. These models inherently incorporate nonlinear effects, both Kerr and Raman, which makes them indispensable tools for the next generation fiber-optic communication systems.

The standard NLSE is a classic partial differential equation. Its many numerical approaches can provide extremely accurate results at the cost of high computational complexity. On the other hand, exact analytical solutions that fits every scenarios without imposing any additional conditions do not exist yet. If exact or approximated analytical solutions under certain practical conditions for the NLSE can be found, they can be used to improve the design of fiber-optic communication systems against nonlinear impairments.

One of the examples of such solutions we envisage is to find the eigenfunction relating to the NLSE (apart from solitons), based on which certain waveforms shaped at the transmitter retain their characteristics after propagation through the channel, i.e. immune to nonlinear distortions, hence enabling more efficient transmission.

Scope

- Identify and formulate the mathematical problem;

- Investigate and solve the mathematical problem;

- Compare and contrast with existing solutions.

Expected Outcome and Deliverables

- An interim report for a survey of existing solutions;

- A technical report for novel solutions and a comparison with existing solutions;

4 Acceptance Criteria

The finding of novel solving approaches for the NLSE, applicable to practical applications.

5 Phased Project Plan

Phase1 (~3 months): survey and analyze the existing solutions; provide a brief interim report.

Phase2 (~6 months): devise novel solutions.

Phase3 (~3 months): write up a technical report.

6 IPR Requirements

For the avoidance of any doubt, both parties agree that neither Huawei's BIPR nor Partner's BIPR should be involved under this agreement. In case of Deliverables developed by Partner, all IPR embodied in the Results or otherwise generated in the performance of this Agreement, shall be exclusively owned by Partner. Partner shall notify Huawei the existence of such IPR at first time and Huawei shall own the preemption right to purchase the IPR. In case of Deliverables developed by Huawei, all IPR embodied in the Results or otherwise generated in the performance of this Agreement, shall be exclusively owned by Huawei.