List of Figures

1.1 Feynmann diagram of Deep Inelastic Scattering 6

1.2 Ladder diagram for DIS in LLQ^2 17

1.3 Helicity conservation at hadronic vertex in QPM (a) and QCD improved parton model (b). The arrows represent the spin orientations [57]. . . . 19

1.4 Leading order Boson Gluon Fusion (BGF) diagram for heavy quark production in *ep*-collisions. 22

1.5 Gluon distribution function extracted at HERA [11]. 24

1.6 The reduced DIS cross section as a function of $y^2/(1+(1-y)^2)$ [11] . 27

2.1 $T^2(t) = T_0.T(t)$ and $T^3(t) = T_1.T(t)$ versus $Q^2(GeV^2)$. 45

2.2 t-evolution results of F_L^g structure function up to NNLO using Taylor expansion method in comparison with the H1, ZEUS data and results of DL model. 53

2.3 x-evolution results of F_L^g structure function up to NLO using Taylor expansion method in comparison with the H1, ZEUS data and results of DL model. 54

2.4 x-evolution results of F_L^g structure function up to NLO using Taylor expansion method in comparison with the H1, ZEUS data and the theoretical prediction of MSTW08. 55

2.5 x-evolution results of F_L^g structure function up to NLO using Taylor expansion method in comparison with the H1, ZEUS data and the theoretical prediction of CT10. 56

2.6 x-evolution results of F_L^g structure function up to NLO using Taylor expansion method in comparison with the H1, ZEUS data and the theoretical prediction of ABM11. 57

2.7 x-evolution results of F_L^g structure function up to NLO using Taylor expansion method in comparison with the H1, ZEUS data and the theoretical prediction of NNPDF2.3. 58

2.8 x-evolution results of F_L^g structure function up to NLO using Taylor expansion method in comparison with the H1 data and the theoretical prediction of Boroun et al. (GRB) 59

3.1 t-evolution results of F_L^g structure function up to NLO using Regge theory in comparison with the H1, ZEUS data and results of DL model. 71

3.2 x-evolution results of F_L^g structure function up to NLO using Regge theory in comparison with the H1, ZEUS data and results of DL model. . 72

3.3 x-evolution results of F_L^g structure function up to NLO using Regge theory in comparison with the H1, ZEUS data and the theoretical prediction of MSTW08. 73

3.4 x-evolution results of F_L^g structure function up to NLO using Regge theory in comparison with the H1, ZEUS data and the theoretical prediction of CT10. 74

3.5 x-evolution results of F_L^g structure function up to NLO using Regge theory in comparison with the H1, ZEUS data and the theoretical prediction of ABM11. 75

3.6 x-evolution results of F_L^g structure function up to NLO using Regge theory in comparison with the H1, ZEUS data and the theoretical prediction of NNPDF2.3. 76

3.7 x-evolution results of F_L^g structure function up to NLO using Regge theory in comparison with the H1 data and the theoretical prediction of Boroun (GRB) [13]. 77

3.8 Comparison of t-evolution results of F_L^g structure function predicted by Regge theory approach and Taylor expansion method and DL model. . 79

3.9 Comparison of x-evolution results of F_L^g structure function predicted by Regge theory approach and Taylor expansion method and DL model. . 80

3.10 Comparison of x-evolution results of F_L^g structure function predicted by Regge theory approach and Taylor expansion method and MSTW08. . 81

3.11 Comparison of x-evolution results of F_L^g structure function predicted by Regge theory approach and Taylor expansion method and CT10. 82

3.12 Comparison of x-evolution results of F_L^g structure function predicted by Regge theory approach and Taylor expansion method and ABM11. . . 83

3.13 Comparison of x-evolution results of F_L^g structure function predicted by Regge theory approach and Taylor expansion method and NNPDF2.3. . 84

4.1 Sensitivity of our results of F_L^g structure function in LO with respect to the expansion point of gluon density at z = 0.5, 0.6, 0.7, 0.8, 0.9 in comparison with H1 data and DL model. 94

4.2 Sensitivity of our results of F_L^g structure function in NLO and NNLO with respect to the expansion point of gluon density at z = 0.5, 0.6, 0.7, 0.8, 0.9 in comparison with H1 data and DL model. 96

4.3 x-evolution results of F_L^g structure function up to NNLO using Taylor expansion method in comparison with the H1, ZEUS data and results of DL model. 98

4.4 x-evolution results of F_L^g structure function up to NNLO using Taylor expansion method in comparison with the H1, ZEUS data and the theoretical prediction of MSTW08. 99

4.5 x-evolution results of F_L^g structure function up to NNLO using Taylor expansion method in comparison with the H1, ZEUS data and the theoretical prediction of CT10. 100

4.6 x-evolution results of F_L^g structure function up to NNLO using Taylor expansion method in comparison with the H1, ZEUS data and the theoretical prediction of ABM11. 101

4.7 x-evolution results of F_L^g structure function up to NNLO using Taylor expansion method in comparison with the H1, ZEUS data and the theoretical prediction of NNPDF2.3. 102

4.8 comparison of our x-evolution results of F_L^g structure function with the results of Sarkar et al (CS) and Boroun et al (GRB). 103

5.1 t-evolution results of F_L^g structure function up to NNLO using Regge theory in comparison with the H1, ZEUS data and results of DL model. 115

5.2 x-evolution results of F_L^g structure function up to NNLO using Regge theory in comparison with the H1, ZEUS data and results of DL model. 116

5.3 x-evolution results of F_L^g structure function up to NNLO using Regge theory in comparison with the H1, ZEUS data and the theoretical prediction of MSTW08. 117

5.4 x-evolution results of F_L^g structure function up to NNLO using Regge theory in comparison with the H1, ZEUS data and the theoretical prediction of CT10. 118

5.5 x-evolution results of F_L^g structure function up to NNLO using Regge theory in comparison with the H1, ZEUS data and the theoretical prediction of ABM11. 119

5.6 x-evolution results of F_L^g structure function up to NNLO using Regge theory in comparison with the H1, ZEUS data and the theoretical prediction of NNPDF2.3. 120

5.7 x-evolution results of R in comparison with the H1 data and the theoretical prediction of ACOT fit. 121

5.8 Comparison of x-evolution results of F_L^g structure function up to NNLO using Regge theory (RT) and Taylor expansion (TE) method in comparison with the H1, ZEUS data and the of DL model. 122

6.1 x-evolution results of F_L^c structure function using Taylor expansion method with the input gluon distribution from DL model. 136

6.2 x-evolution results of F_2^c structure function using Taylor expansion method in comparison with the H1, ZEUS data. 137

6.3 x-evolution results of the ratio of the charm quark structure functions R^c using Taylor expansion method. 138

6.4 x-evolution results of charm quark reduced cross section σ_r^c using Taylor expansion method in comparison with the H1, ZEUS data. 139

6.5 Comparison of our results of F_L^c at $Q^2 = 20, 200GeV^2$ using Taylor expansion method with the results of colour dipole model (CDM) and Boroun et al (GRB). 140

6.6 Comparison of our results of F_2^c at $Q^2 = 20, 200GeV^2$ using Taylor expansion method with the results of DL, colour dipole model (CDM) and Boroun et al (GRB). 140
6.7 Results of the charm content of F_L structure function K_L^c with respect to x at $Q^2 = 20, 200GeV^2$ using Taylor expansion method. 141
6.8 x-evolution results of F_L^c structure function using Regge theory with the input gluon distribution from DL model. 143
6.9 x-evolution results of F_2^c structure function using Regge theory in comparison with the H1, ZEUS data. 144
6.10 x-evolution results of the ratio of the charm quark structure function R^c using Regge theory. 145
6.11 x-evolution results of the charm quark reduced cross section σ_r^c using Regge theory in comparison with the H1, ZEUS data. 146
6.12 Comparison of our results of F_L^c at $Q^2 = 20, 200GeV^2$ using Regge theory with the results of CD model and Boroun et al (GRB). 147
6.13 Comparison of our results of F_2^c at $Q^2 = 20, 200GeV^2$ using Regge theory with the results of DL, CD model and Boroun et al (GRB). 147
6.14 Results of the charm content of F_L structure function K_L^c with respect to x at $Q^2 = 20, 200GeV^2$ using Regge theory. 148
6.15 x-evolution results of F_L^b structure function using Taylor expansion method with the input gluon distribution from DL model. 150
6.16 x-evolution results of F_2^b structure function using Taylor expansion method in comparison with the H1, ZEUS data. 151
6.17 x-evolution results of the ratio of the beauty quark structure functions R^b using Taylor expansion method 152
6.18 x-evolution results of the beauty quark reduced cross section σ_r^b using Taylor expansion method in comparison with the H1, ZEUS data. . . . 153

6.19 Comparison of our results of F_2^b at $Q^2 = 200GeV^2$ using Taylor expansion method with the results of MSTW 08. 154
6.20 Results of the beauty content of F_L structure function K_L^b with respect to x at $Q^2 = 25, 200GeV^2$ using Taylor expansion method. 154
6.21 x-evolution results of F_L^b structure function using Regge theory with the input gluon distribution from DL model. 156
6.22 x-evolution results of F_2^b structure function using Regge theory in comparison with the H1, ZEUS data. 157
6.23 x-evolution results of the ratio of the beauty quark structure functions R^b using Regge theory. 158
6.24 x-evolution results of the beauty quark reduced cross section σ_r^b using Regge theory in comparison with the H1, ZEUS data. 159
6.25 Comparison of our results of F_2^b at $Q^2 = 200GeV^2$ using Regge theory with the results of MSTW08 parameterization. 160
6.26 Results of the beauty content of F_L structure function K_L^b with respect to x at $Q^2 = 25, 200GeV^2$ using Regge theory. 160
6.27 Comparison of our results of σ_r^c obtained by Taylor expansion (TE) method and Regge theory (RT). 161
6.28 Comparison of our results of σ_r^b obtained by Taylor expansion (TE) method and Regge theory (RT). 162
6.29 Sensitivity of our results of σ_r^b and σ_r^c with mass renormalization scale μ obtained by Taylor expansion (TE) method and Regge theory (RT). . . 163