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#include <stdio.h>
#include <stdlib.h>
#include <math.h>

#define MAX_ANGLE (1 << 10)
// #define STR_PR

int main (int argc, char *argv[])
{
    FILE *fin1, *fin2;
    int i, num;

    char str_real[MAX_ANGLE][30];
    char str_fixed[MAX_ANGLE][30];

    double A_real[MAX_ANGLE];
    double A_fixed[MAX_ANGLE];
    double A_freal[MAX_ANGLE];
    double A_delta[MAX_ANGLE];
    double cos_delta[MAX_ANGLE];
    double sin_delta[MAX_ANGLE];

    fin1 = fopen("angle_real.dat", "r");
    fin2 = fopen("angle_real_out.dat", "r");

    if (fin1 == NULL) {
        perror ("Unable to open file fin1 \n");
        exit( EXIT_FAILURE);
    }

    if (fin2 == NULL) {
        perror ("Unable to open file fin2 \n");
        exit( EXIT_FAILURE);
    }

    i = 0;

    while (fscanf(fin1, "%s", &str_real[i]) != EOF) {
        fscanf(fin2, "%s", &str_fixed[i]);

        A_real[i] = atof(str_real[i]);
        A_fixed[i] = atof(str_fixed[i]);

        A_freal[i] = A_fixed[i] / (1L << 29);
        A_delta[i] = A_real[i] - A_freal[i];

        printf("[%2d] ", i);
#ifdef STR_PR
        printf("str_real= %20s ", str_real[i]);
        printf("str_fixed= %12s ", str_fixed[i]);
#endif
        printf("A_real= %25.19e ", A_real[i]);
        printf("A_freal= %25.19e ", A_freal[i]);
        printf("A_delta= %25.19e ", A_delta[i]);
        printf("\n");
        i++;
    }
    num = i;

    for (i=0; i<num; ++i) {
        cos_delta[i] = cos(A_real[i]) - cos(A_freal[i]);

        printf("[%2d] ", i);
        printf("cos(A_real)= %25.19e ", cos(A_real[i]));
        printf("cos(A_freal)= %25.19e ", cos(A_freal[i]));
        printf("cos_delta= %25.19e ", cos_delta[i]);
        printf("\n");
    }
}

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}

for (i=0; i<num; ++i) {
    sin_delta[i] = sin(A_real[i]) - sin(A_freal[i]);

    printf("[%2d] ", i);
    printf("sin(A_real)= %25.19e ", sin(A_real[i]));
    printf("sin(A_freal)= %25.19e ", sin(A_freal[i]));
    printf("sin_delta= %25.19e ", sin_delta[i]);
    printf("\n");
}

double A_delta_avg  = 0.0;
double cos_delta_avg = 0.0;
double sin_delta_avg = 0.0;
double A_delta_max  = 0.0;
double cos_delta_max = 0.0;
double sin_delta_max = 0.0;
double A_delta_min  = 9999L;
double cos_delta_min = 9999L;
double sin_delta_min = 9999L;
for (i=0; i<num; ++i) {
    A_delta[i] = fabs(A_delta[i]);
    cos_delta[i] = fabs(cos_delta[i]);
    sin_delta[i] = fabs(sin_delta[i]);
    A_delta_avg += A_delta[i];
    cos_delta_avg += cos_delta[i];
    sin_delta_avg += sin_delta[i];
    if (A_delta_min > A_delta[i]) A_delta_min = A_delta[i];
    if (cos_delta_min > cos_delta[i]) cos_delta_min = cos_delta[i];
    if (sin_delta_min > sin_delta[i]) sin_delta_min = sin_delta[i];
    if (A_delta_max < A_delta[i]) A_delta_max = A_delta[i];
    if (cos_delta_max < cos_delta[i]) cos_delta_max = cos_delta[i];
    if (sin_delta_max < sin_delta[i]) sin_delta_max = sin_delta[i];
}
A_delta_avg /= num;
cos_delta_avg /= num;
sin_delta_avg /= num;

printf("|A_delta| (min= %g avg= %g max= %g)\n",
        A_delta_min, A_delta_avg, A_delta_max);
printf("|cos_delta| (min= %g avg= %g max= %g)\n",
        cos_delta_min, cos_delta_avg, cos_delta_max);
printf("|sin_delta| (min= %g avg= %g max= %g)\n",
        sin_delta_min, sin_delta_avg, sin_delta_max);

fclose(fin1);
fclose(fin2);

return 0;
}

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